

# Construction Flora and Fauna Management Plan

Moorebank Precinct East Stage 1 – RALP No. 1

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## Document Approval

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07	21 May 2019				Updates from RfMA018, RfMA019, RfMA021, and RfMA022
Signature:					



## Details of Revision Amendments and Authorship

### Document Control

The Project Director is responsible for ensuring that this plan is reviewed and approved. The Environment Manager is responsible for updating this plan to reflect changes to legal and other requirements, as required.

### Amendments

Any revisions or amendments must be approved by the Project Director before being distributed / implemented.

### Revision Details

Revision	Details
A	Initial draft for SIMTA review
B	Updated to address reviewer comments
C	For SIMTA's second review
D	Updated to address final CoAs and for consultation
E	Updated to incorporate the results of original Biodiversity Assessment of RailCorp land
F	For submission to DP&E. Updated to address stakeholder consultation and ER review comments.
G	Updated in response to comments by DP&E and with final biodiversity assessment
H	Additional update for submission to DP&E
I	Updated in response to comments from SIMTA. Revision H track changes still shown.
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06	Updated following RfMA0011, RfMA0012, RfMA0015 and RfMA0016 with ER Approval
07	Updates from RfMA018, RfMA019, RfMA021, and RfMA022

### Document Authors, Reviewers and Qualifications

This document has been prepared and reviewed by appropriately qualified professionals as detailed below.

Author's Name	Qualifications
██████████ ██████████████████	Bachelor of Science in Environmental Biology (Hnours), University of Newcastle Upon Tyne, UK BioBanking, Biodiversity Certification and Major Projects Offsets Accredited Assessor Ecological Consultants Association of New South Wales – Practicing Member
██████████	Master of Environmental Engineering Management, University of Technology Sydney Bachelor of Engineering, University of Technology Sydney
██████████	Master of Science, Environmental Management, University of Cape Town
██████████████████	Master of Environmental Engineering Management, University of Technology Sydney Bachelor of Engineering (Civil & Environmental), University of Technology Sydney
██████████	Master of Environmental Science and Law, University of Sydney Bachelor of Science, University of Sydney
██████████	Masters of Applied Science in Environmental Science, Sydney University Post Graduate Diploma in Safety Science, University of New South Wales Bachelor of Business Administration majoring in Environmental Resource Management, Macquarie University
██████████████████	Bachelor of Engineering in Environmental Engineering (Honours), University of Western Australia

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# Construction Flora and Fauna Management Plan

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## 1. Overview

### 1.1 Purpose

This Construction Flora and Fauna Management Plan (CFFMP) addresses flora and fauna management on Sydney Intermodal Terminal Alliance's (SIMTA) Moorebank Precinct East (MPE) Stage 1 – Rail Access Land Package (RALP) No. 1 (the Project, the Rail Link) and the management of impacts to the environment and community.

This CFFMP addresses the following key requirements:

- Conditions of Approval under SSD-6766 SIMTA Intermodal Terminal Facility – Stage 1 (NSW)
- Stage 1 Environmental Impact Statement
- Stage 1 Response to Submissions Report (including Final Compilation of Mitigation Measures)
- Conditions of Approval under MP10\_0193 SIMTA Moorebank Intermodal Terminal Facility – Concept Plan (NSW)
- NSW Concept Plan Environmental Impact Statement
- NSW Concept Plan Submissions Report (including Revised Statement of Commitments)
- Conditions of Approval under EPBC 2011/6229 SIMTA Intermodal Terminal (Commonwealth)
- Commonwealth Concept Plan EIS
- Other applicable legislative obligations
- Address the requirements of the EPL
- CPB Management System

### 1.2 Project Scope

SIMTA's MPE Stage 1 Development involves the construction and operation of the necessary infrastructure to support a container freight road volume of 250,000 twenty-foot equivalent units (TEU).

CPB Contractors' scope of work specifically applies to MPE Stage 1 RALP No. 1 which consists of a 2.8 kilometre rail line, along with its required infrastructure, to connect the Import-Export Terminal and Interstate Terminals to the Southern Sydney Freight Line (SSFL), and capable of accommodating trains up to 1,800m in length.

The SIMTA site is located in the Liverpool local government area. It is 27 kilometres south-west of the Sydney Central Business District (CBD), 26 kilometres west of Port Botany, 16 kilometres south of the Parramatta CBD, 0.6 kilometres from the M5 South-West Motorway, five kilometres east of the M5 South-West Motorway / Westlink M7 Motorway Interchange and connecting to the main north–south rail line via the Southern Sydney Freight Line.

The RALP No. 1 is the first package of Stage 1 of the overall MPE project and its construction will include:

- A northbound connection and a southbound connection to the SSFL
- Civil and earthworks, including remediation works and benching
- A Reinforced Earth Embankment (RE-Wall) through a section of the Glenfield Waste Services landfill site
- A bridge over the Georges River
- A culvert crossing over Anzac Creek
- Installation of new Moorebank Avenue overbridge
- Service relocation and protection
- Track work
- Signalling systems
- Security fencing

An indicative map of the Project is provided in Figure 1 below.

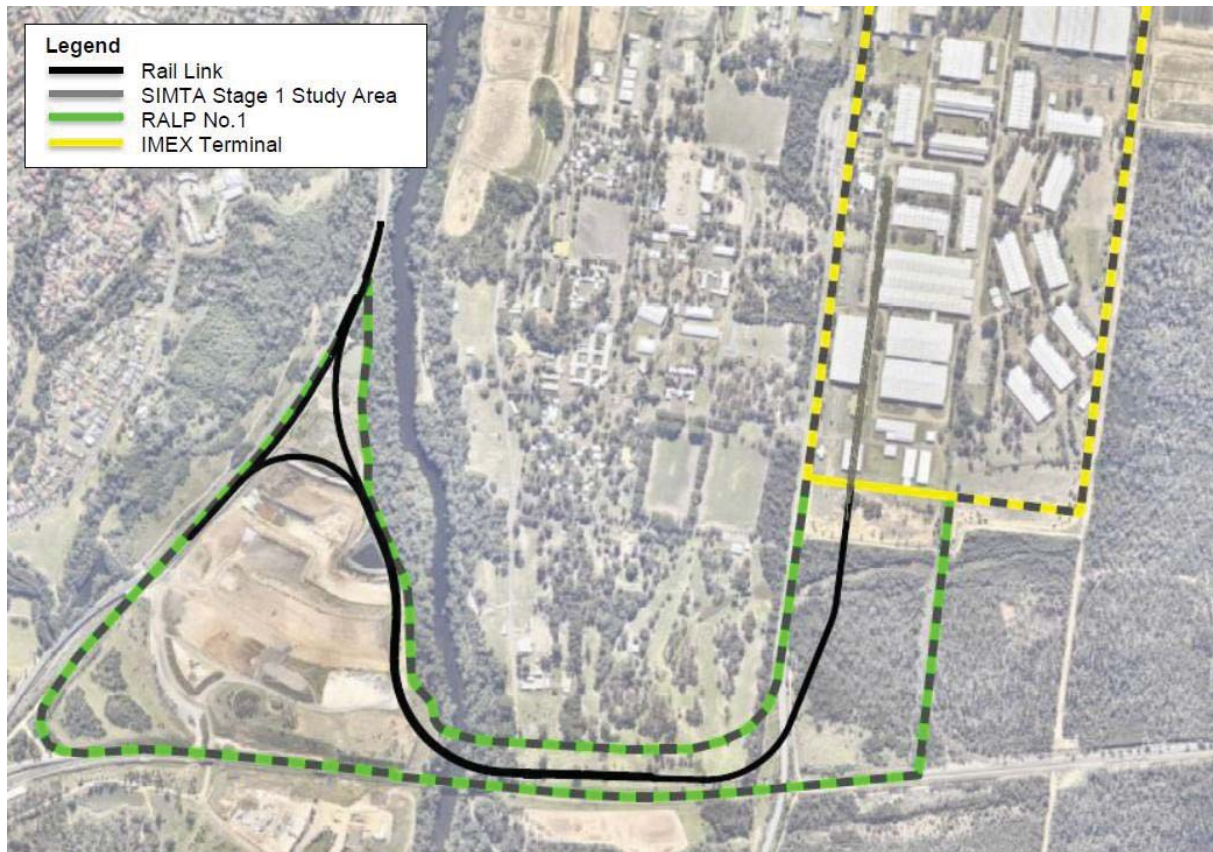


Figure 1: Indicative Project Map

### 1.3 Construction Methodology

The duration of construction is anticipated to be approximately 18 months. The location of the Rail Link is indicated in Figure 1. These works generally involve:

- Establishment of three construction compounds to support the Rail Link construction (the Rail East Compound, the Georges River Bridge Compound and the Rail West Compound) providing car parking, offices, amenities, laydown and storage, and material testing areas.
- Clearing of approximately 1.23 hectares (ha) of native vegetation.
- Construction of the Rail Link from the SSFL to the Stage 1 site, including a bridge over the Georges River, a culvert over Anzac Creek and alteration to the Moorebank Avenue bridge (over the East Hills Rail Corridor).
- Movement of fill material from the Rail Link.
- Construction of access and egress to and from the Rail Link from Moorebank Avenue and Cambridge Avenue (through the Glenfield Waste Facility).

#### 1.3.1 Construction Schedule

Construction of the Rail Link commenced in the 2nd half of 2017. The indicative construction schedule as detailed in the EIS and copied here in Figure 2 had projected a construction timeline of approximately 18 months from commencement. Due to unforeseen delays associated with the unidentified finds relating to *Hibbertia* sp. on the project and landowner access issues west of the Georges River, project completion is now expected by end of 2019 or approximately 30 months.

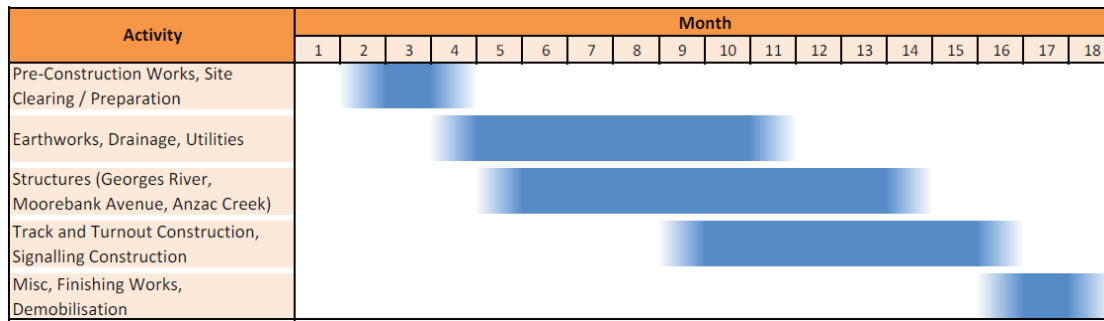


Figure 2: Environmental Documents Map

## 1.4 Objectives

The objectives for flora and fauna management are to:

- Minimise vegetation clearance
- Minimise impacts on Endangered Ecological Communities
- Minimise impacts on threatened species
- Minimise impacts on retained significant trees and other retained vegetation
- Offset the loss of habitat trees through installation of nest boxes in adjacent woodland
- Protect retained and adjacent native vegetation
- Control the spread of weeds
- Minimise disturbance to fauna.

## 1.5 Definitions

Definitions for terms used throughout this plan are provided in the glossary in Attachment B.

## 1.6 Interactions with Other Management Plans

This CFFMP is part of the Construction Environmental Management Plan (CEMP). Figure 3 below sets out interactions of this CFFMP with the other management plans implemented on the Project.

Furthermore, this CFFMP makes reference to a number of associated management plans and documents that are attached, including:

- Attachment E: Weed Management Strategy
- Attachment F: Nest Box Management Strategy
- Attachment G: Aquatic Ecology Monitoring Plan
- Attachment J: Hibbertia Species Survey Plan
- Attachment L: Threatened Dragonfly Species Survey Plan
- Attachment M: The Riparian Vegetation Management Plan (RVMP)



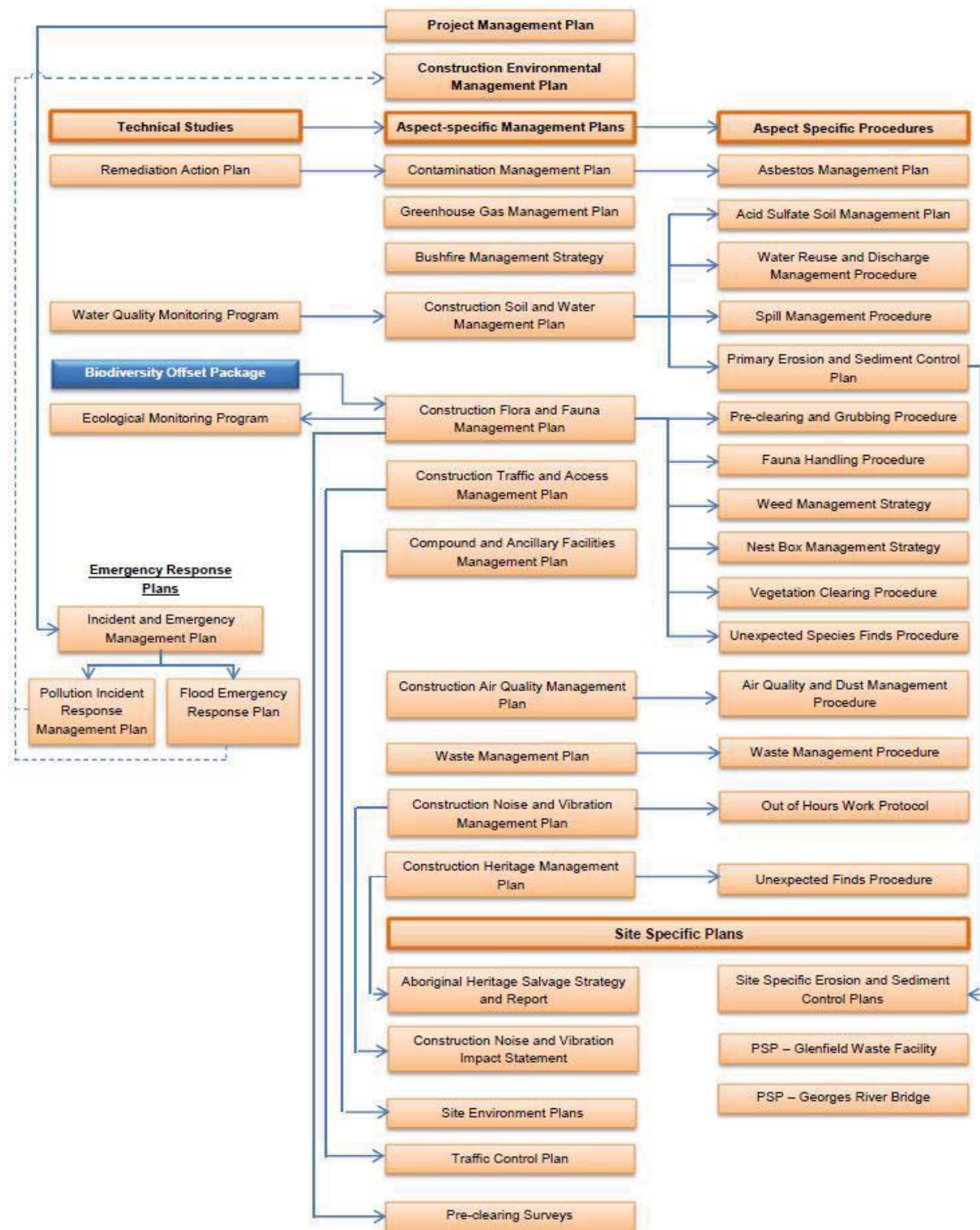


Figure 3: Environmental Documents Map

## 2. Legal and Other Requirements

### 2.1 Conditions of Project Environmental Approvals

The compliance of this document with the various environmental approval documents is demonstrated in Attachment A.

### 2.2 Relevant Legislation

The Project is designated State Significant Development (SSD) and has been assessed under Part 4 Division 4.1 of the EP&A Act. Key legislation relevant to the management of flora and fauna for the Rail Link project includes:

- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth)
- *Threatened Species Conservation Act 1995* (TSC Act)
- *Fisheries Management Act 1994* (FM Act)
- *Noxious Weeds Act 1993* (NW Act)
- *Biosecurity Act 2015*
- *National Parks and Wildlife Act 1974* (NPW Act)
- *Pesticides Act 1999*

Relevant and applicable provisions of the aforementioned legislation are detailed within the CEMP.

### 2.3 Guidelines and Information Sources

Various guidelines and information sources have been referenced in the development of the CFFMP and associated management plans, including:

- Asparagus Weeds Best Practice Management Manual
- Atlas of Living Australia, 2015. Threatened species records accessed through the Atlas of Living Australia.
- Aurecon 2016b, Nest Box Management Strategy.
- Aurecon 2016a, Weed management Strategy.
- Australian Government, 2014. SIMTA Moorebank Intermodal Terminal Facility, Sydney, NSW EPBC Approval (EBPC 2011/6229)
- Australian Government, 2015. Protected Matters Search Tool.
- Australian Standard, 2009. AS 4970–2009 Protection of trees on development sites.
- Bureau of Meteorology, 2015. National Atlas of Groundwater Dependent Ecosystems.
- Cumberland Ecology, *Hibbertia* Species Survey Plan, April 2018.
- DEC and Department of Primary Industries, 2005. Guidelines for Threatened Species Assessment.
- DEC, 2004. Threatened Biodiversity Survey and Assessment Guidelines (working draft).
- DEC, 2006. *Persoonia nutans* R Br (Nodding Geebung) Recovery Plan. NSW Department of Environment and Conservation, Hurstville NSW.
- DECC, 2005. Recovering Bushland on the Cumberland Plain. Best practice guidelines for the management and restoration of bushland.
- DECCW, 2011. Cumberland Plain Recovery Plan.
- Department of Planning and Environment 2015. SSD 6766 Conditions of Approval
- Hyder Consulting, 2015a. SIMTA Intermodal Terminal Stage 1: Environmental Impact Statement.
- Hyder Consulting, 2015b. SIMTA Intermodal Terminal Stage 1: Response to Submissions Report.
- Hyder Consulting, 2015c. Threatened Flora Species Management Plan.
- Hyder Consulting, 2015d. Riparian Vegetation Management Plan.
- McNaught, I., Thackway, R., Brown, L. and Parsons, M 2008. A Field Manual for the Surveying and Mapping of Nationally Significant Weeds.
- NSW DPI, 2014. Noxious and Environmental Weed Control Handbook, 6th Edition.

- NSW DPI, 2016. NSW WeedWise profiles for noxious and environmental weeds.
- NSW National Parks and Wildlife Service, 2000. Environmental Impact Assessment Guidelines; Cumberland Plain Large Land Snail.
- OEH, 2014. Framework for Biodiversity Assessment.
- OEH, 2015. Threatened Species Profile Database.

## 2.4 Additional Permits and Licences

The following permits will be needed:

Table 1: Additional permits and licences required

Approval Authority	Act	Permit / Licence	Timing	Responsibility
OEH	S132c of the National Parks and Wildlife Act 1974	Permit to collect seed and plant propagules from River Flat Eucalypt Forest EEC	Construction	Environment Manager Environmental Coordinator Project Ecologist
OEH	S132c of the National Parks and Wildlife Act 1974	Permit to undertake revegetation and restoration works within River Flat Eucalypt Forest and Freshwater Wetlands EECs	Construction	Environment Manager Environmental Coordinator Project Ecologist Bush regeneration contractor
OEH	S132c of the National Parks and Wildlife Act 1974	Licence to harm, trap, study, collect voucher specimens, release fauna, pick, hold, study fauna	Construction	Project Ecologist Environment Manager (secondary)
APVMA	Agricultural and Veterinary Chemicals Code Act 1994	Permits for herbicide use, particularly if a non-registered use is proposed (i.e. for Alligator Weed)	Construction	Environment Manager Environmental Coordinator
OEH	Threatened Species Conservation Act 1995	Licence for translocation of threatened species	Construction	Environment Manager Environmental Coordinator Project Ecologist
DPI	S37 and S216 of the Fisheries Management Act 1994	- Special Approval For Research or Other Authorised Purposes - Licence for translocation of native aquatic species	Construction	Environment Manager Project Ecologist
DPI	NSW Biosecurity Act 2015	Permit for removal and transport of Alligator Weed	Construction	Environment Manager Project Ecologist

### 3. Consultation and Stakeholders

#### 3.1 Consultation on this Plan

In accordance with the conditions of the Stage 1 Project Approval this CFFMP has been developed in consultation with Office of Environment and Heritage and Department of Primary Industries – Fishing and Aquaculture.

Further, this CFFMP as a Sub Plan to the CEMP is required to be approved by the Department of Planning and Environment as well as the Department of the Environment and Energy (Commonwealth) prior to construction as required by the Stage 1 Project Approval and the Commonwealth Concept Plan Approval.

Consolidated management plan consultation and approval requirements are identified in the CEMP.

This consultation is intended to assist in development and finalisation of the plan. Evidence of consultation is included in Attachment D.

Table 2 summarises relevant stakeholder comments as well as CPB Contractors' response including how we will address issues raised.

Table 2: Summary of Consultation

Agency	Status	Document Reference	Stakeholder Comments	CPB Response
DPI Fisheries	Comments received 18/01/2017	p. 12, s. 4.2; p. 25, table 11, measure FF1, s.7.8, Table 11	Page 33, FF57: This mitigation measure doesn't seem to be complied with in the relative initial progressive erosion and sediment control plans for works on the banks of the Georges River.	Mitigation measure #SW5 and SW#18 in Table 5 (section 7.8) of the SWMP requires that all materials are stockpiled away from water flow paths, which is a CPB Contractors Mandatory Minimum. Comments on initial progressive erosion and sediment control plans (e.g. stockpiles, including mulch, located away from watercourses) are noted and will be provided to ERS&D specialist prior to development of site specific ESCPs.
		p. 14, s. 5.1, table 4	Training/project inductions should include information on fire prevention (e.g, cigarette disposal).	Noted - section 4.2 updated
Office of Environment and Heritage (OEH)	Comments received 2/02/2017	p. 15, s. 5.2.1; p. 24, s. 7.2	Other threatened flora (ie Acacia bynoeana, Hibbertia fumana and Hibbertia puberula subsp. puberula) and additional records for previously found threatened flora (ie Persoonia nutans) within the Rail Link project area from the October/November 2016 surveys by Arcadis should be included. Relevant information needs to be included or amended in subsequent sections (eg s. 5.3, 5.3.1, 5.3.2, 6.2 (table 8), 7.8	Noted – sections updated to include new findings on Hibbertia puberula subsp. Puberula. Hibbertia fumana has not been found within the Rail Link project.

Agency	Status	Document Reference	Stakeholder Comments	CPB Response
			(table 11), 8.2, Sensitive Area Maps (Appendix C).	
		p. 17, s. 5.4.3	<p>OEH has not reviewed the biodiversity assessment undertaken within the RailCorp land but it is surprising that no additional threatened species were found given the existence of the Castlereagh Scribbly Gum Woodland Threatened Ecological Community and the very close proximity to threatened species in the adjoining Southern Boot area (ie <i>Acacia bynoeana</i>, <i>Hibbertia fumana</i>, <i>Hibbertia puberula</i> subsp. <i>puberula</i>, <i>Persoonia nutans</i>, <i>Grevillea paviflora</i> subsp. <i>paviflora</i>).</p>	<p>Noted - additional assessment for species with relevant habitat in the RailCorp land have been undertaken by SIMTA (February 2017), with the results incorporated into the CFFMP as appropriate.</p> <p>The February 2017 study indicated that that the site represented poor habitat for threatened species but was consistent with disturbed regrowth.</p> <p>The February 2017 study also indicated that two (2) stems of <i>Hibbertia puberula</i> subsp. <i>puberula</i> were located approximately 50m to the East of the rail corridor along the fence border. Several stands of <i>Grevillea parviflora</i> subsp. <i>parviflora</i> were identified further to the Southeast, outside the impact area and adjoining areas of land.</p> <p>The memo summarizing the findings is provided in Appendix I.</p>
		p. 20, s. 6.1, Table 6	Typo, 1 <sup>st</sup> line.	Noted - updated
		p. 21, s. 6.3	Additional hazards and risks (eg fire and fuel/chemical spills) should be included.	Noted - updated
		p. 23, s. 7.2	Text missing in 3 <sup>rd</sup> line.	Noted - updated
		p. 23, s. 7.2; p. 27, s. 7.8, table 11, measure FF 12	Text missing 2 <sup>nd</sup> last dot point re: translocation.	This dot point is not referring to the translocation. Amended for clarification.
		p. 26, s. 7.8, table 11, measure FF3	Any translocation will require a licence (which may not be provided) and should only be done in accordance (or not conflict) with the Biodiversity Offset Package (BOP).	Dot point added into section 7.2 for translocation. Further clarification added to Mitigation measure FF12 regarding the requirement for a licence. This would be

Agency	Status	Document Reference	Stakeholder Comments	CPB Response
				obtained by the Project Ecologist.
		p. 26, s. 7.8, table 11, measure FF4	Where is the 'biodiversity study area' and how does it relate/differ from the rail corridor area? It is not clear what circumstances would require the clearing of any vegetation outside that considered by the Stage 1 assessment. Any additional vegetation clearing: - will need to be justified; - require approval; and - be addressed in the BOP.	This mitigation measure is taken directly from the Final Compilation of Mitigation Measures #8A for the project. The Biodiversity Study Area is the area assessed in the EIS. The rail corridor is the area of impact. No clearing is proposed outside the project footprint without further assessment and approval. Mitigation measure updated to include further clarification
		p. 28, s. 7.8, table 11, measure FF16; p. 31, s. 7.8, table 11, measure FF39; p. 36, s. 8.1	Advice should also be provided to DPE regarding the results of pre-clearance surveys. Directions should also be sought from DPE regarding the clearing of vegetation if Grey-headed Flying-fox roosting is detected.	Results of pre-clearance surveys can be provided to DP&E and other parties upon request. Section 8.1 and 8.2 list monitoring/reporting requirements, which includes for GHFF. It mentions reports will be provided as required/requested
		p. 29, s. 7.8, table 11, measure FF28	OEH has not reviewed the Threatened Flora Species Management Plan in the Response to Submissions Report (Appendix J – Biodiversity Assessment Report) but notes it will need to be amended as a result of the October/November 2016 surveys.	Noted.
		p. 29, s. 7.8, table 11, measure FF29	No planting or direct seeding should occur within the area subject to the Southern Boot (future BioBanking?) area.	This is a requirement of the Riparian Vegetation Management Plan (part of the RtS) and is only to occur within the riparian zones of the Georges River and Anzac Creek. The mitigation measure has been clarified.
		p. 31, s. 7.8, table 11, measures FF38, FF39 and FF40	Typo in 2 <sup>nd</sup> dot point.	Noted - updated
		p. 31, s. 7.8, table 11, measures FF38, FF39, FF40, FF42, FF43 and FF44.	Biodiversity Offset Plan should be Biodiversity Offset Package.	These requirements are taken directly from the Threatened Flora Species Management Plan. The terms are



Agency	Status	Document Reference	Stakeholder Comments	CPB Response
				interchangeable and "Biodiversity Offset Package" has been added after the terms in the sections noted. The responsibility for implementing the Biodiversity Offset Package is with SIMTA. CPB will provide all necessary information/assistance to ensure compliance.
		p. 31, s. 7.8, table 11, measures FF42.	The Southern Boot (future BioBanking?) area is outside the Rail Link construction area and is a 'no-go' area so it is not clear why the activities in these measures are relevant to this CFFMP - they should be addressed in the BOP which is yet to be developed.	These areas are "no-go" areas for construction however will be accessed as part of work for the riparian vegetation management. The area will be inspected/monitored by the Project Ecologist and Environment Manager as required by other associated plans (e.g. Threatened Flora Species Management Plan or Nest Box Management Strategy)
		p. 31, s. 7.8, table 11, measures FF43.	It is unclear what this measure entails.	This requirement is taken straight from the Threatened Flora Species Management Plan. It refers to the Boot land offset site, so a reference has been added to the Biodiversity Offset Package/Plan. The Biodiversity Offset Package is the responsibility of SIMTA and this has been included as well.
		p. 33, s. 7.8, table 11, measure FF58	It is unclear what this measure entails. The removal of 'large shrubs' within a Threatened Ecological Community is of concern.	This requirement is taken straight from the Threatened Flora Species Management Plan. It refers to the Boot land offset site, so a reference has been added to the Biodiversity Offset Package/Plan. The Biodiversity Offset Package is the responsibility of SIMTA and this has been included as well.
		p. 34, s. 7.8, table 11, measure FF67	Typo, 2 <sup>nd</sup> line	Noted - updated

Agency	Status	Document Reference	Stakeholder Comments	CPB Response
		p. 34, s. 7.8, table 11, measure FF70	Typo, 1 <sup>st</sup> /2 <sup>nd</sup> line.	Noted - updated
		p. 37, s. 8.2	It is not clear why access to 'no-go' areas would be required during the construction phase - circumstances under which an entry permit would be required area should be detailed. If justified, permits to enter 'no-go' areas should be issued/authorised by the Project Ecologist and Environment Manager.	All possible circumstances under which a permit could be required cannot be listed. They will be dealt with on a case by case basis through the permit system. Permits to enter will be signed off by the appropriate person. No-go areas are for construction activities and does not preclude authorised personnel from entering. See FF2, FF7, FF10 for more information
		p. 39, s. 9	The final number of all threatened species cleared should be reported (not just the two stated).	Noted - updated to include all threatened species
		p. 39, s. 9.2	Subsections on fuel/chemical spillages and fires should be included.	Fuel and chemical spills are addressed through the Pollution Incident Response Management Plan (PIRMP). The CFFMP is not the appropriate document to detail response to spills or fire incidents.
		p. 63+, Ecology No-Go Area Maps (Appendix C)	The meaning of the last sentence of the 1 <sup>st</sup> paragraph is not clear.	Noted - updated
Office of Strategic Lands	Comments received 2/02/2017	N/A	Advised that they had no comments	Noted. Consultation with OSL no longer required under the revised conditions of approval.
OEH	OEH advice on updated Biodiversity Assessment Report (BAR)	L&EC Judgement on 2017/81889 dated 6 <sup>th</sup> March 2018	Point 18 of judgement documents OEH's acceptance of the BAR	Noted – extract of judgement included in Attachment D to demonstrate OEH endorsement of most recent mapping.



## 4. Roles and Responsibilities

### 4.1 Key Personnel

The role titles and responsibilities that are used in this plan are outlined in Table 3.

Table 3: Roles and Responsibilities

Role	Responsibilities
Project Director	<ul style="list-style-type: none"> <li>Manage the delivery of the project</li> <li>Contractor's Principal Representative.</li> <li>Manage the delivery of the construction process in relation to flora and fauna management across all sites in conjunction with the Environment Manager.</li> </ul>
Environment Manager	<ul style="list-style-type: none"> <li>Oversee the implementation of all flora and fauna management strategies</li> <li>Manage the flora and fauna reporting and monitoring</li> <li>Stakeholder liaison</li> <li>Track and report flora and fauna management against targets.</li> </ul>
Environmental Coordinator	<ul style="list-style-type: none"> <li>Manage the on-ground application of flora and fauna management measures during construction</li> <li>Monitor and report on flora and fauna management during construction.</li> </ul>
Environmental Representative	<ul style="list-style-type: none"> <li>Independent expert for environmental management of the Rail Link project</li> <li>Responsible for ensuring that CPB comply with the mitigation measures and safeguards documented in their CEMP.</li> </ul>
Design Manager	<ul style="list-style-type: none"> <li>Ensure relevant flora and fauna management requirements are addressed in design development.</li> </ul>
Construction Manager	<ul style="list-style-type: none"> <li>Manage the delivery of the construction process in relation to flora and fauna management across all sites in conjunction with the Environment Manager.</li> </ul>
Project Engineers	<ul style="list-style-type: none"> <li>Manage the delivery of the construction process in relation to flora and fauna management across all sites in conjunction with the Environment Manager.</li> <li>Implement flora and fauna management activities during construction works.</li> </ul>
Superintendent	<ul style="list-style-type: none"> <li>On-ground implementation and adherence with flora and fauna management requirements.</li> </ul>
Communications Manager	<ul style="list-style-type: none"> <li>Manage stakeholder expectations regarding the implementation of the CEMP and sub-plans.</li> </ul>
Project Ecologist	<ul style="list-style-type: none"> <li>Provide technical expertise where required and undertake the prescribed tasks such as pre-clearance surveys and fauna rescue and relocation.</li> </ul>

Further details regarding the roles and responsibilities of key personnel are provided in the CEMP.

### 4.2 Training

The flora and fauna component of the Project Induction will include information on:

- Sensitivity of surrounding vegetation, as shown on Site Environment Plans (SEP) detailing clearing boundaries, and environmental no-go areas for construction activities
- Sensitivity of threatened fauna species
- Site environmental procedures relating to flora and fauna (tree clearing and grubbing, sediment and erosion control, weed control)

- Emergency and incident response/spill management (chemical spills, fire, injured fauna)
- What to do if you find native animals on the worksite.
- Nearby threatened flora species that are to be protected (refer to Section 5.3)
- Fire prevention/controls for work around bushland

Relevant personnel (i.e. contractors involved in survey, vegetation clearing, construction and other activities that have the potential to impact flora and fauna) will receive training appropriate to their role in the management of potential impacts on flora and fauna during the project. Ongoing toolbox talks on the requirements for management of flora and fauna will be used to raise and maintain awareness among the wider project team and will cover aspects such as:

- Vegetation Clearing Procedure (Attachment K)
- Reinforcement of information from inductions and where procedures are amended or new procedures are introduced
- Unexpected Threatened Species Procedure (Attachment K)
- Fauna Handling Procedure (refer to [Section 9.3](#))
- Identification of nearby threatened flora species (refer to [Section 5.3](#))
- Fire prevention, particularly for work near EEC.

## 5. Existing Environment

### 5.1 Flora and Fauna Values

This chapter summarises the existing flora and fauna constraints of the Rail Link project and adjoining area (study area) based on the information presented within the Project BAR (Arcadis 2017), MPE Stage 1 Rail Link – Threatened Flora Species (Arcadis, 2017), and Hibbertia Species Survey Plan (Cumberland Ecology, 2018). Project mapping, contained in Attachment C, references source files obtained from the Project Bar (Arcadis 2017) in accordance with requirements of CoA E34(d). Refer to the Project BAR (Arcadis 2017) for biodiversity mapping.

Flora and fauna values across the study area are summarised in Table 4 and Table 5.

Table 4: Threatened Ecological Communities within the Rail Link Project

Vegetation Type	EEC Name	TSC Act Status	EPBC Act Status
Hard-leaved Scribbly Gum - Parramatta Red Gum Heathy woodland of The Cumberland Plain, Sydney Basin Bioregion	<i>Castlereagh Scribbly Gum Woodland in the Sydney Basin bioregion</i>	Vulnerable	Endangered
Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	<i>Castlereagh Swamp Woodland</i>	Endangered	Not listed
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	<i>River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions</i>	Endangered	Not listed
Forest Red Gum – Rough barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	<i>Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions.</i>	Endangered	Not listed

Table 5: Threatened Flora and Fauna Species Habitat within the Biodiversity Study Area

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
<b>Threatened Flora</b>			
<i>Persoonia nutans</i>	Nodding Geebung	Endangered	Endangered
<i>Grevillea parviflora subsp. parviflora</i>	Small-flowered Grevillea	Vulnerable	Vulnerable
<i>Hibbertia puberula subsp. puberula</i>	Guinea Flower	Endangered	Not listed
<i>Hibbertia fumana</i>	Hibbertia fumana	Critically Endangered	Not listed
<b>Threatened Flora nearby to Rail Link but outside area of impact</b>			
<i>Acacia byoeana</i>	Bynoe's Wattle	Endangered	Vulnerable
<i>Acacia pubescens</i>	Downy wattle	Vulnerable	Vulnerable
<b>Threatened Terrestrial Fauna</b>			
<i>Cercartatus nanus</i>	Eastern Pygmy Possum	Vulnerable	Not listed
<i>Myotis macropus</i>	Southern Myotis	Vulnerable	Not listed
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	Vulnerable	Not listed

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	Vulnerable	Not listed
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Vulnerable	Vulnerable
<b>Threatened Aquatic Fauna</b>			
<i>Macquaria australasica</i>	Macquarie Perch	Endangered (FM Act)	Endangered

## 5.2 Terrestrial Flora

The Project BAR (Arcadis 2017) identified four native vegetation communities within the Rail Link project and adjoining areas, all of which are consistent with threatened ecological communities currently listed under the EPBC Act and/or TSC Act. In addition to these, three vegetation types that do not have the structure or function of a native vegetation community were identified, including:

- Landscaped vegetation
- Modified native vegetation
- Cleared/disturbed areas.

Table 6 provides a description of the key diagnostic species for each native vegetation community, in addition to their extent and location. The condition of vegetation within the study area varies according to the level of disturbance and recruitment of exotic species. Exotic species were noted as being prolific within the River-flat Eucalypt Forest and Freshwater Wetland vegetation communities.

Table 6: Native Vegetation Communities Identified within the Rail Link Project

Vegetation Type	Characteristic Canopy Species	Extent and Location in the Rail Link project
Hard-leaved Scribbly Gum - Parramatta Red Gum Heathy woodland of The Cumberland Plain, Sydney Basin Bioregion	<ul style="list-style-type: none"> <li>■ <i>Eucalyptus sclerophylla</i></li> <li>■ <i>Eucalyptus parramattensis</i></li> </ul>	0.74 ha of relatively intact vegetation along Anzac Creek.
Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	<ul style="list-style-type: none"> <li>■ <i>Eucalyptus parramattensis</i></li> <li>■ <i>Melaleuca linariifolia</i></li> <li>■ <i>Melaleuca decora</i></li> </ul>	0.05 ha of vegetation located within the Anzac Creek riparian corridor.
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	<ul style="list-style-type: none"> <li>■ <i>Eucalyptus saligna</i> x <i>botryoides</i></li> <li>■ <i>Eucalyptus longifolia</i></li> </ul>	0.41 ha of vegetation within the Georges River riparian corridor in the western portion of the Rail Link project.
Forest Red Gum – Rough barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	<ul style="list-style-type: none"> <li>■ <i>Typha orientalis</i></li> <li>■ <i>Bolboschoenus fluviatilis</i></li> </ul>	0.03 ha of aquatic vegetation within Anzac Creek.

### 5.2.1 RailCorp Land

An initial biodiversity assessment was undertaken by Arcadis of the RailCorp land south of the MPE site, with the inspection undertaken in March 2016, as required per FCMM 8A c). Arcadis undertook an additional targeted survey in February 2017 to determine potential project impacts associated with the Rail Link, and a further survey was undertaken by Cumberland Ecology in November 2017. A requirement in the case brought against the Rail Link project before the Land & Environment Court of NSW (L&EC) (case #2017/00081889) and was to determine likely impacts to *Hibbertia* species by the project.

All surveys carried out in the RailCorp land indicate that while the southern portion of the site is highly disturbed and weedy, the northern section is consistent with disturbed regrowth of Castlereagh Scribbly Gum Woodland and meets the definition of TEC under the TSC Act and EPBC Act. Impacts to this TEC is consistent with the impacts assessed in the Stage 1 EIS's BAR (Hyder Consulting 2015)

and revised BAR for the development consent as submitted to the OEH (Arcadis, 2017). The site represents poor habitat for threatened species recorded in the EIS to the north and east of the site, due to site being largely cleared until 2004.

The February 2017 study also indicated that two (2) stems of *Hibbertia puberula* subsp. *puberula* were located approximately 50m to the East of the rail corridor along the fence border. Several stands of *Grevillea parviflora* subsp. *parviflora* were identified further to the Southeast, outside the impact area and adjoining areas of land.

The November 2017 survey as part of the Hibbertia Species Survey Plan (CoA Condition C23) didn't identify any additional Hibbertia stems within the RailCorp land that wasn't previously identified by the February 2017 study.

The results of the Arcadis surveys are included the memorandum in Attachment I and results from the Cumberland Ecology survey plan is included in Attachment J.

### 5.3 Threatened Flora

A total of 12 threatened flora species listed under the TSC Act were predicted to occur within the Rail Link project in the EIS, including:

- Bynoe's Wattle *Acacia bynoeana*
- *Dillwynia tenuifolia*
- *Hibbertia puberula*
- *Hibbertia* sp. *Bankstown*
- *Hypsela sessiliflora*
- Netted Bottle Brush *Callistemon linearifolius*
- *Persoonia nutans*
- *Pimelea curviflora* subsp. *curviflora*
- *Grevillea parviflora* subsp. *parviflora*
- Thick Lip Spider Orchid *Caladenia tessellata*
- White-flowered Wax Plant *Cynanchum elegans*
- Woronora Beard-heath *Leucopogon exolasius*.

Of these 12 threatened species, 6 were assessed as having potential habitat within the vegetation recorded. Three threatened flora species from those listed under the TSC Act as predicted to occur within the Rail Link project were recorded during field surveys conducted for the BAR (Arcadis, 2017), including:

- *Persoonia nutans*
- *Grevillea parviflora* subsp. *parviflora*.
- *Hibbertia puberula* subsp. *puberula*.

The BAR also notes that in response to EPBC Act conditions of approval, Bynoe's Wattle *Acacia bynoeana* and *Hibbertia* sp. *Bankstown* (syn. *Hibbertia puberula* subsp. *glabrescens*) were also targeted during the threatened flora surveys. Neither of these species were recorded within the project footprint, however *Acacia bynoeana* (Bynoe's Wattle) was recorded to the east and south-east of the development site within the study area.

Additional threatened flora species, listed under the TSC Act and were not identified during field surveys detailed in the EIS, have since been recorded during surveys (October 2016, February 2017, and November 2017). These species are:

- *Hibbertia fumana*
- *Acacia bynoeana*
- *Acacia pubescens* (Downy Wattle)

Of these species, *Hibbertia puberula* subsp. *puberula* and *Hibbertia fumana* have been identified within the area impacted by the Rail Link. The *Acacia bynoeana* is located approximately 140m from the Rail Link and *Acacia pubescens* is located approximately 690 metres from the Rail Link, and therefore not subject to impact by the Rail Link.

Additional detailed targeted surveys of the RailCorp land and the area above Anzac Creek were undertaken in February 2017 and November 2017, in response to the discoveries in October 2016.

Further information on the individual species and number/location of plants identified after the EIS is provided in section 5.3.1 below.

### 5.3.1 Additional Threatened Flora Species recorded on the Boot Land

Recent surveys (October 2016, February 2017, and November 2017) within the Boot Land, between the eastern side of Moorebank Avenue to west of Wattle Grove and south of the MPE IMEX terminal, have identified additional threatened plant species listed under the NSW *Threatened Species Act 1995* (TSC Act), two of which are also listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The records of these species were not identified in the EIS. *Hibbertia fumana*, a species previously known only from historical herbarium records and presumed to be extinct, has been discovered in the Boot Land. This species has subsequently been given a provisional listing as Critically Endangered under the TSC Act. A total of 721 plants of *Hibbertia fumana* has been recorded in the Boot Land survey area, predominantly in woodland areas with a more open understory in a long transitional zone between Castlereagh Ironbark Forest and Castlereagh Scribbly Gum Woodland.

The MPE Stage 1 Rail Link will directly impact the population of *Hibbertia fumana* recorded within the Boot Land, and of the 406 plants recorded in respective Boot land surveys, approximately 197 plants (171 confirmed, 13 tentative, and 13 assumed) will be impacted by the proposal. This represents a predicted impact of 27% of the total number of plants recorded in the Boot land. The impacts to this species will be offset in the Biodiversity Offset Package, as required under Condition of Approval C23A.

The MPE Stage 1 Rail Link will directly impact on *Hibbertia puberula* subsp. *Puberula*. A total of 1,371 *Hibbertia puberula* subsp. *Puberula* stems were identified in the recent surveys, including a number in close proximity to the construction footprint. The 186 *Hibbertia puberula* subsp. *Puberula* stems predicted to be impacted by the proposal represents less than 14% of the total number of plants recorded in the recent surveys of the boot land. The impacts to this species will be offset in the Biodiversity Offset Package, as required under Condition of Approval C23A.

The closest record of *Acacia bynoeana* recorded in the recent surveys is 140 metres to the east of the Rail Link and therefore this species will not be directly impacted by the project.

The closest record of *Persoonia nutans* recorded in recent (post EIS) surveys is 20 metres to the west of the Rail Link. Previous records of this species, identified and assessed in the Stage 1 EIS (Hyder, 2015), are located north of Anzac Creek and are impacted by the project.

In accordance with requirements of the conditions of the MPE Stage 1 Approval (SSD-6766), the EPBC approval (2011/6086) and the concept plan approvals, it is proposed to conserve a large portion of the Boot Land and manage it as part of biodiversity offsetting for the MPE concept approval.

The locations of the additional threatened species identified in the recent surveys and located within 100m of the Rail Link have been included in the Sensitive Areas Maps in Attachment C. The mitigation measures listed in the Threatened Flora Species Management Plan (Response to Submissions – Appendix J – Biodiversity Assessment Report) that are applicable to the *Grevillea parviflora* subsp. *parviflora* have been also adopted for the newly discovered species in the CFFMP, as their listing under the TSC Act is similar and this was deemed the most appropriate by the ecologist.

### 5.3.2 *Persoonia nutans*

*Persoonia nutans* was recorded in the Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland north of Anzac Creek, within the Rail Link project. Repeated targeted searches for this species has resulted in a total of 197 individual plants being recorded in surveys between 2012 and 2017. Targeted searches for this species as part of the EIS identified 110 plants within the Rail Corridor (as defined in the Project EIS), of which 11 of those plants were within the construction footprint of the Rail Link. Of the 110 plants in the Rail Corridor, 108 were in the Southern Boot Land. A single individual was found south of Anzac Creek and another individual was found further north, in the land known as the former DNSDC south. Subsequent surveys following the EIS has identified 89 plants west of the rail spur and 35 plants were recorded east of the rail spur.



### 5.3.3 *Grevillea parviflora subsp. parviflora*

*Grevillea parviflora subsp. parviflora* was recorded in the large patch of Castlereagh Scribbly Gum Woodland south of Anzac Creek in the Rail Corridor, within the Southern Boot Land. A total of 1644 stems of *G. parviflora subsp. parviflora* were recorded on both sides of the existing rail spur in 2011-2012 from 4 metre wide transects spaced 10m apart. As the survey method sampled 40 per cent of the survey area, the population within the study area were estimated to be approximately 4110 stems. Repeated transect surveys in 2014 and 2015 in the development site to the west of the existing rail spur found a total of 2825 stems with a population estimate of approximately 7036 stems. A further survey in May 2017 as identified in the BAR (Arcadis, 2017) identified a further 6 stems within the Boot Land.

Intensive surveys in July 2012 focused on the population of *G. parviflora subsp. parviflora* in the vicinity of the Rail Link project. These surveys involved counting all stems within approximately 25m either side of the centre line of the proposed rail link, and were undertaken over an area of approximately 0.37 ha. A total of 842 stems were recorded in this area, resulting in a much higher density of plants than the transect surveys. It was also noted during this survey that the species was recorded in areas where it had not been recorded in May 2011. The number of genetically distinct individuals is likely to be lower than this estimate given the suckering habit of this species and the localised high density of plant stems observed. The BAR estimates from surveys carried out in November 2014 and January 2015 that 20 stems were likely to be impacted as a result of the project and this total replaces previous estimates of impact to the species (Arcadis, 2017).

## 5.4 Terrestrial Fauna Habitat

Five broad terrestrial fauna habitat types were identified within the Project BAR (Arcadis, 2017), of which four occur within the Rail Link project:

- Remnant vegetation
- Riparian habitats
- Landscaped areas
- Buildings (not within Rail Link project)
- Cleared and disturbed areas.

### 5.4.1 Remnant Vegetation

Within this broad habitat type, remnant vegetation was found to contain both remnant woodland and remnant forest. Remnant woodland communities occur across the Rail Link project and the Southern Boot Land south of the Intermodal Terminal Facility. The low canopy is dominated by eucalypts and melaleucas, providing potential nesting, roosting and sheltering habitat for birds. Hollow-bearing trees were recorded in low densities and would provide valuable roosting and nesting habitat for a range of arboreal fauna in the locality. Remnant forest upslope of the Georges River riparian zone supports large canopy trees, predominantly eucalypts, providing nesting and sheltering habitat to woodland birds. Both the remnant forest and woodland have a shrub layer that offers sheltering and foraging habitat for birds and well-developed leaf litter and ground layer vegetation offers habitat for reptiles. Micro-chiropteran bat species were also recorded foraging in this fauna habitat type.

### 5.4.2 Riparian habitats

Anzac Creek is heavily vegetated and contains pools of open water providing habitat for common amphibians. The dense understorey of flowering shrubs in the riparian zone provide sheltering, nesting and foraging habitat for a variety of birds. Well-developed leaf litter and small ground timber offers shelter and foraging habitat to small terrestrial mammals and reptiles.

Riparian vegetation associated with Georges River is highly disturbed on both the western and eastern banks. An abundance of trees supporting small to medium-sized branch hollows are located on the western bank of the Georges River, offering potential nesting and roosting habitat to hollow-dependent fauna. Decorticating bark of eucalypts offer potential roosting habitat to microbat species. A diversity of microbat species were recorded in May 2012 in Georges River riparian vegetation. Dense infestations of weeds offer potential sheltering and foraging habitat to birds adapted to disturbed habitats. Leaf litter and small ground timber offers shelter and foraging habitat to small terrestrial mammals and reptiles.

#### 5.4.3 Landscaped areas

Landscaped areas occur at the northern extent of the Rail Link project and consist of isolated trees amongst expanses of mown exotic and native grasses. Isolated trees offer potential nesting, sheltering and roosting habitat to birds and flowering eucalypts also provide foraging habitat for nectivorous birds and bats. A diversity of microchiropteran bat species were also recorded in cleared and disturbed areas.

Open grassy areas provide foraging habitat for ground-feeding birds and small terrestrial mammals. Depressions in open areas that contain temporary water, following rain events offer habitat to colonising amphibians.

#### 5.4.4 Cleared and disturbed areas

The type and abundance of habitat features within cleared and disturbed areas are limited, as native vegetation has been almost entirely cleared. Weedy exotic herbs and grasses may offer sheltering and foraging habitat to small mammals and reptiles, while native shrubs and small trees may offer roosting, nesting, sheltering and foraging habitat to small birds.

### 5.5 Aquatic Fauna Habitat

Anzac Creek is a watercourse with intermittent flow supporting semi-permanent to permanent water in pools and as such, is classified as Class 3 (Minimal Fish Habitat) in accordance with Fairfull and Witheridge (2003). The Anzac Creek AUSRIVAS sampling site falls into Band B, indicating that the macroinvertebrate community was 'significantly impaired';

Georges River comprises a major permanently flowing river and as such, is classified as Class 1 (Major Fish Habitat) in accordance with Fairfull and Witheridge (2003). It is also mapped as 'Key Fish Habitat' on DPI's Key Fish Habitat map for the Sydney Metropolitan area. Aquatic habitats of Georges River within the Rail Link project included soft substrate pool habitat, large woody debris and extensive macrophyte cover. Overhanging vegetation, fallen logs, mats of sticks, submerged (and floating aquatic plants were present along the bank. This extensive macrophyte cover of submerged and floating aquatic plants has reduced the heterogeneity of aquatic habitat and most likely affects the composition of the macroinvertebrate community present. The Georges River AUSRIVAS sampling site falls into B and C in accordance with the AUSRIVAS model, indicating that it is 'severely impaired'.

### 5.6 Threatened Terrestrial Fauna

The project BAR (Arcadis, 2017) assessed the potential for threatened fauna to utilise the habitat resources of the study area applying the methodology of the Framework for Biodiversity Assessment (FBA) (OEH 2014). This methodology separates threatened fauna species into those that can be predicted to occur based on the presence of habitat surrogates (ecosystem credit species) and those that cannot (species credit species).

Eight species were identified in the BioBanking credit calculator (based on the information held within the threatened species profile database (OEH 2015)) as predicted fauna species credit species, of which six were considered to have potential habitat within the study area, including:

- Cumberland Plain Land Snail *Meridolum corneovirens*
- Eastern Osprey *Pandion cristatus*
- Eastern Pygmy-possum *Cercartetus nanus*
- Green and Golden Bell Frog *Litoria aurea*
- Koala *Phascolarctos cinereus*
- Regent Honeyeater *Anthochaera phrygia*.

An additional 24 ecosystem credit species were identified as being predicted to occur within the vegetation communities recorded within the study area (based on the information held within the threatened species profile database (OEH 2015)). Of these 24, 20 were considered to have potential habitat within the study area, including:

- Australian Painted Snipe *Rostratula australis*
- Barking Owl *Ninox connivens*
- Black-chinned Honeyeater *Meliphreptus gularis subsp. Gularis*



- Brown Treecreeper *Climacteris picumnus subsp. Victoriae*
- Bush-stone Curlew *Burhinus grallarius*
- Diamond Firetail *Stagonopleura guttata*
- Eastern False Pipistrelle *Falsistrellus tasmaniensis*
- Eastern Freetail-bat *Mormopterus norfolkensis*
- Gang-gang Cockatoo *Callocephalon fimbriatum*
- Greater Broad-nosed Bat *Scoteanax rueppellii*
- Hooded Robin *Melanodryas cucullata subsp. Cucullata*
- Little Eagle *Hieraaetus morphnoides*
- Little Lorikeet *Glossopsitta pusilla*
- New Holland Mouse *Pseudomys novaehollandiae*
- Scarlet Robin *Phoenica boodang*
- Speckled Warbler *Chthonicola sagittata*
- Spot-tailed Quoll *Dasyurus maculatus maculatus*
- Swift Parrot *Lathamus discolor*
- Varied Sitella *Daphoenositta chrysoptera*
- Yellow-bellied Sheath-tail-bat *Saccolaimus flaviventris*.

Four threatened fauna species were recorded or potentially recorded during surveys for the Project BAR (Arcadis, 2017) and were subsequently considered as candidate credit species. All of these species had habitat mapped within the Rail Link project. Three microchiropteran bats listed as 'Vulnerable' under the TSC Act were recorded or potentially recorded: *Southern Myotis*, *Eastern Freetail-bat* and *Eastern Bentwing-bat*. One megachiropteran bat listed as 'Vulnerable' under the TSC Act and EPBC Act was also recorded: *Grey-headed Flying-fox*. Additionally, one species, *Eastern Pygmy Possum* (Vulnerable under the TSC Act), was assumed to be present based on the presence of suitable habitat and anecdotal records in bushland further south of the site, on Defence land within Holsworthy Military Area.

## 5.7 Threatened Aquatic Fauna

The EPBC Act Protected Matters Search identified two threatened fish species, also threatened under the FM Act, with the potential to occur in the study area or potential habitat within 10 km of the study area, namely:

- Black Rockcod *Epinephelus daemeli* (Vulnerable, EPBC Act and FM Act)
- Macquarie Perch *Macquaria australasica* (Endangered EPBC Act and FM Act).

The Black Rockcod is a marine species that occurs in rocky habitats and reefs and as such, would not occur within the Georges River or Anzac Creek.

Georges River in proximity to the study area does not provide preferred breeding habitat (riffles over cobble and gravel substrates) though it supports potential foraging and refuge habitat. The species was recorded in 2008 in the Georges River near Campbelltown, approximately 15 km upstream of the study area, the first record from the river since 1894 (Atlas of Living Australia 2015).

The Fisheries Management Act 1994 also lists two species of endangered dragonfly that have the potential to be located in the area, namely:

- Adams Emerald Dragonfly *Archaeophya adamsi* (Endangered, FM Act)
- Sydney Hawk Dragonfly *Austraocordulia leonardi* (Endangered, FM Act)

A survey on threatened dragonfly species was conducted in September 2016 as part of the project's consent requirements, and outcome of this survey determined the project study area does not provide preferred habitat for endangered dragonflies.

The Threatened Dragonfly Species Survey Plan Report is included in Attachment L.

## 5.8 Wildlife Corridors and Connectivity

The study area is located within a relatively industrialised and urbanised landscape. Larger expanses of habitat within the study area (within the Southern Boot Land) are isolated from habitat adjacent to

the study area, due to the presence of significant barriers to fauna movement. These barriers include Moorebank Ave, the East Hills Rail Line and Main Southern Railway line and chain-mesh fencing surrounding the SIMTA site, Glenfield Waste Facility, Southern Boot Land and MIC site. The chain-mesh fencing would limit movement into and through the study area to small terrestrial mammals, reptiles, amphibians and birds and bats. Larger terrestrial mammals that may occur in the locality would be excluded from much of the study area as a result.

Beyond the study area there are substantial areas of intact native vegetation contained within the Holsworthy Military Area (to the south of the SIMTA site, on the southern side of the East Hills Rail Corridor). Holsworthy Military Area comprises approximately 18,000 ha of continuous native vegetation, much of which has remained largely undisturbed as a result of restricted access into the Military Area.

## **5.9 Groundwater Dependent Ecosystems**

A search of the Australian Government's Atlas of Groundwater Dependent Ecosystems was undertaken and it was noted that no data on subterranean groundwater-dependent ecosystems (GDEs) is available for the locality, although several GDEs with potential reliance on subsurface groundwater were identified in the locality and the study area (Bureau of Meteorology 2015). The riparian woodland vegetation of Anzac Creek and the Georges River was identified as having a high potential for groundwater interaction. Other woodland vegetation in the Southern Boot Land was identified as having a moderate potential for groundwater interaction.

## 6. Aspects and Potential Impacts

### 6.1 Activities, Hazards and Risks

Activities conducted on the project that have the potential to impact flora and fauna listed below.

Table 7: Activities, Hazards and Risks

Project Activity	Environmental Hazard	Environmental Risk
Worksite establishment	<ul style="list-style-type: none"> <li>Clearing, grubbing and stripping of vegetation</li> <li>Movement of light and heavy vehicles</li> <li>Fire</li> <li>Chemical spills (including fuel)</li> </ul>	<ul style="list-style-type: none"> <li>Loss of threatened flora and fauna habitat.</li> <li>Loss of threatened communities.</li> <li>Inadvertent removal of threatened species.</li> <li>Inadvertent removal of habitat for threatened species.</li> <li>Inadvertent removal of endangered ecological communities.</li> <li>Cumulative loss of vegetation from the landscape.</li> <li>Fragmentation of habitat from installation of fencing along the Rail link.</li> <li>Loss of foraging, nesting and roosting areas.</li> <li>Loss of riparian vegetation.</li> <li>Loss of habitat connectivity.</li> <li>Loss of hollow bearing trees and fauna habitat.</li> <li>Loss of biodiversity due to changes in hydrological function.</li> <li>Lowering of water quality.</li> <li>Impacts to groundwater dependent ecosystems.</li> <li>Loss of biodiversity due to weed infestation.</li> <li>Clearing outside of approved area.</li> <li>Introduction of soil pathogens.</li> </ul>
Rail Link Construction	<ul style="list-style-type: none"> <li>Movement of light and heavy vehicles</li> <li>Work during low light</li> <li>Out-of-hours work</li> <li>Fire</li> <li>Chemical spills (including fuel)</li> </ul>	<ul style="list-style-type: none"> <li>Loss of biodiversity due to changes in hydrological function</li> <li>Lowering of water quality.</li> <li>Impacts to groundwater dependent ecosystems.</li> <li>Impacts on aquatic biodiversity due to changes in hydrological function and lowering of water quality during construction.</li> <li>Loss of biodiversity due to weed infestation.</li> <li>Light impact on nocturnal fauna.</li> <li>Loss of threatened flora and fauna habitat.</li> <li>Loss of threatened communities.</li> <li>Introduction of soil pathogens.</li> </ul>
Bridge Construction	<ul style="list-style-type: none"> <li>Work in riparian areas</li> <li>Work in water courses</li> <li>Temporary works in watercourses</li> <li>Fire</li> <li>Chemical spills (including fuel)</li> </ul>	<ul style="list-style-type: none"> <li>Loss or reduction of fish passage in the Georges River.</li> <li>Loss of biodiversity due to changes in hydrological function.</li> <li>Lowering of water quality.</li> <li>Impacts to groundwater dependent ecosystems.</li> <li>Impacts on aquatic biodiversity due to changes in hydrological function and lowering of water quality during construction.</li> <li>Loss of biodiversity due to weed infestation.</li> <li>Loss of riparian vegetation.</li> <li>Loss of habitat connectivity.</li> </ul>

### 6.2 Threatened Species and Ecological Communities

The anticipated impacts on threatened flora, fauna and ecological communities that were assessed in the Project EIS, and additional surveys undertaken in October 2016 and February 2017, are outlined in Table 8 to Table 10 below.

Table 8: Required clearance of threatened ecological communities within the Rail Link project

Vegetation Type	EEC Name	TSC Act Status	EPBC Act Status	Extent to be cleared (ha)
Hard-leaved Scribbly Gum – Parramatta Red Gum Heathy	Castlereagh Scribbly Gum Woodland in the Sydney Basin bioregion	Vulnerable	Endangered	0.74

Vegetation Type	EEC Name	TSC Act Status	EPBC Act Status	Extent to be cleared (ha)
woodland of The Cumberland Plain, Sydney Basin Bioregion				
Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	Castlereagh Swamp Woodland	Endangered	-	0.05
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions	Endangered	-	0.41
Forest Red Gum – Rough barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions.	Endangered	-	0.03
Total	-	-	-	1.23

Table 9: Required Clearance of Threatened Flora within the Rail Link Project

Scientific Name	TSC Act Status	EPBC Act Status	Maximum number to be permitted to be cleared	Estimated number to be cleared
<i>Persoonia nutans</i>	Endangered	Endangered	17	11
<i>Grevillea parviflora subsp. parviflora</i>	Vulnerable	Vulnerable	634	20 (approximately)
<i>Hibbertia puberula subsp. puberula</i>	Endangered	Not listed	186	186
<i>Hibbertia fumana</i>	Critically Endangered	Not listed	197	197

Table 10: Threatened Fauna Species Specific Habitat to be Cleared within the Project

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Area of habitat to be cleared (ha)
<i>Cercartatus nanus</i>	Eastern Pygmy Possum	Vulnerable	-	0.75
<i>Myotis macropus</i>	Southern Myotis	Vulnerable	-	1.25

### 6.3 Fauna Habitat

Clearing of vegetation for the Rail Link project will result in the loss of terrestrial fauna habitat, reducing the local extent of available resources. In addition to the habitat types listed in Table 11, the project EIS identified three hollow bearing trees within the Rail Link project to be cleared, and since the commencement of clearing activities in July 2017, an additional 32 hollow bearing trees / limbs have been identified on the project for removal during clearing activities, increasing the interim total to 35 hollow trees / limbs. Refer to Figure 3 of the NBMS in Attachment F showing locations of hollow bearing trees identified within and in proximity to the Rail Link.

The removal of these trees will remove some habitat resources for hollow dependant fauna. Clearing within the riparian corridors of Georges River and Anzac Creek will be limited to a (maximum) corridor of 20 metres of native vegetation.

Table 11: General Fauna Habitat to be Cleared within the Rail Link Project

Fauna Habitat Type	Area to be cleared (ha)
Remnant Vegetation (including forest and woodland)	0.88
Riparian Habitat (including Georges River and Anzac Creek)	0.32
Landscaped	0.24
Cleared and Disturbed	8.06

The Project EIS notes that habitat features and vegetation communities that will be cleared are prevalent within the wider landscape, particularly within the Holsworthy Military Reserve to the south and Boot Land to the east of the Rail Link project.

#### 6.4 Aquatic Environment

Construction activities, including boring, piling and construction of piers, have the potential to increase sediment loads and reduce water quality on Georges River, downstream of the Rail Link project. This could reduce the suitability of aquatic environments for some aquatic flora and fauna species.

Although the Rail Link project includes the construction of bridge piers in the river, fish passage will be maintained throughout construction and operation.

A culvert crossing will be installed on Anzac Creek which will result in permanent changes to flow and potentially fish passage. However, changes would be minimal as the culvert crossing has been designed to follow the natural shape of the channel and scour protection will be installed at the outlets to prevent erosion.

A 'Threatened Dragonfly Species Survey Plan' was developed in consultation with DPI Fisheries and contained in Attachment L. No threatened dragonfly species, listed under the *Fisheries Management Act 1994*, were found and there was no evidence of suitable habitat in proximity to the Rail Link. If endangered dragonfly species are discovered during construction, DPI Fisheries will be contacted and stop work protocols will be followed per the Unexpected Species Finds Procedure.

#### 6.5 Wildlife Corridors and Connectivity

The clearing of native vegetation for construction of the Rail Link project is unlikely to reduce fauna movement throughout the locality. This localised clearing may, however, result in a reduced capacity for less mobile fauna (such as small reptiles and amphibians) to move between patches of habitat to be retained.

Two key biodiversity links were noted as being impacted by the Rail Link project: Cumberland Plain Priority Lands and Georges River riparian corridor. The impacts to the Georges River riparian corridor impacts would be temporary and short term due to revegetation following completion of construction.

#### 6.6 Groundwater Dependent Ecosystems

The temporary nature of the construction activities limited extent of potential disturbance to groundwater means that prolonged impacts on groundwater are not predicted as a result of the Rail Link project. It was noted that whilst the Rail Link project would make the ground slightly more impervious, recharge to groundwater systems would be minimally impacted. The Rail Link project is not expected to result in impacts on groundwater quality and quantity. Furthermore, surface water flows from the site are not expected to significantly change as a result of the Rail Link project.

## 7. Management, Controls and Mitigation Measures

Controls to manage the risks associated with flora and fauna will be implemented before any relevant works commence. Elimination of the hazard is the first preference of control, followed by engineering, then administrative controls. A comprehensive list of control measures, including those from the Final Compilation Mitigation Measures and Commonwealth Approval, is provided in Table 12. Processes for specific, higher risk, activities to be implemented are provided in Section 7.3 to Section 7.8 below.

### 7.1 Impact Minimisation

Measures to avoid and minimise impacts to biodiversity values have been implemented throughout the site selection and planning phase of the Rail Link project. Section 6 of the BAR (Arcadis 2017) details the measures that have been implemented to date. In summary, the measures relating to biodiversity include:

- Alterations to the Rail Link alignment that has reduced impacts to *Grevillea parviflora subsp. parviflora* from 641 stems to approximately 20 stems.
- Limiting the footprint of the Rail Link project to a 20 metre wide corridor to minimise impacts on threatened species and TECs.
- Limiting the clearing within the riparian corridor of Anzac creek and Georges River to no greater than 20 metres wide.
- General site selection of an already industrialised area that is well located for transport connectivity into existing road and rail infrastructure.

Impact minimisation during the construction phase will be implemented through the environmental mitigation measures and process outlined below and within Table 12.

### 7.2 Flora Translocation

The requirement to translocate a set number or all threatened species located within the Rail Link will be consulted on and agreed to with the Principals Ecologist prior to commencement of clearing works for the Rail Link within the Boot Land. Species to be considered for translocation, in accordance with CoA Condition E31A, include those detailed in the BAR (Arcadis, 2017) and the Hibbertia Species Survey Plan (Cumberland Ecology, 2017), as well as those identified in subsequent pre-clearance surveys as outlined in Section 7.3 below.

Any translocation of threatened species within the Boot Land will occur into areas that have been identified as requiring rehabilitation within the Biodiversity Offset Package, consistent with condition E31A. Applicable licences and permits issued under the TSC Act shall be obtained prior to the commencement of any translocation activities, and any translocation required will occur prior to mainline clearing of the Rail Link through the Boot land.

### 7.3 Pre-clearance Surveys

Pre-clearance surveys will be completed by the Project Ecologist prior to the commencement of clearing activities for the Rail Link.

At least 48 hours prior to the pre-clearing survey, high visibility exclusion fencing (can include signage, star pickets and wire, bollards and flagging, ATF fencing or other high visibility fencing to demarcate the area) will be erected along the boundary of approved vegetation clearance (with reference to AS 4970–2009 *Protection of trees on development sites*). Similarly, this fencing will be installed around the watercourse works areas prior to the completion of the pre-clearing assessment. The installation of fencing prior to the pre-clearing survey will allow for an accurate assessment of the biodiversity values to be cleared. Tree protection fencing will be reviewed by an Arborist if required.

The methodology applied for the surveys will vary depending on the location and surrounding flora and fauna constraints but will typically record the following information:

- Variations to the mapped boundaries of threatened ecological communities
- Threatened flora species that occur within the area to be cleared, including:
  - Whether these are expected or unexpected finds (see Section 9.2)
  - The number of plants/stems that will be impacted by the clearance activities.
  - The survey must target the species listed in Section 5.3 as a minimum



- The presence of GHFF roosting camps within the rail easement (to be conducted no more than 48 hours prior to the clearance of potential GHFF roosting habitat by a suitably qualified expert with tertiary qualifications and/or a minimum of five years demonstrated relevant experience)
- The adequacy of signage and high visibility fencing along the clearance boundary to minimise the risk of unintentional or inadvertent clearing
- The presence of any hollow bearing trees
- The presence and occupation status of any nests or drays
- Details of any fauna microhabitat or instream features (such as coarse woody debris) to be salvaged and relocated prior to clearing (including details of suitable sites)
- The location of any noxious weeds within the vegetation to be cleared, as per section 5.1 of the Weed Management Strategy (Appendix E)

DP&E approval of the Hibbertia Species Survey plan (Attachment J) and deferment of BAR (Arcadis, 2017) approval by DP&E until 12 months following the commencement of construction within the Boot land, is included on the Form to Permit to Clear Land or Vegetation, and accepted for any clearing for the Rail Link in the Boot land in accordance with Condition C23 & Condition C23A.

This information will be recorded and stored on a standardised Form for Permit to Clear Land or Vegetation (Attachment H) and will include a signoff from the person completing the assessment (the Project Ecologist) and the Environment Manager. This form will be completed after the pre-clearing inspection checklist (Attachment K) has been completed. All clearing activities will be undertaken as per the Vegetation Clearing Procedure (Attachment K).

The methodology outlined above will also be applied for any additional areas that need to be cleared outside of the Rail Link project. Where this preclearance assessment identifies the presence of any biodiversity values, additional actions including modification environmental assessments and biodiversity offsets calculations may be required.

#### 7.4 Protection of Threatened Flora Species

Additional protection for threatened flora species (listed in section 5.3) adjacent to the construction boundary is required to ensure that the level of clearing is below that which is permitted within project approval documents.

Where construction is within 10 metres of a threatened flora record, as identified on the Sensitive Area Maps (Attachment C), exclusion fencing comprising bollards and flagging, ATF fencing or star pickets and wire, clearly marked "No-go Zone" will be installed. Threatened species inside the area to be cleared will be marked with flagging tape during the pre-clearance survey and counted prior to clearing commencing.

The Environmental Coordinator shall maintain a register of the number of stems/plants of each species that have been cleared. If the cumulative total approaches the limits outlined in Table 9, the Environmental Coordinator shall notify the Superintendent, Environment Manager and Project Director to ensure that clearing ceases once the approved limit is reached. If further clearing is required at this point, additional assessment and approvals must be sought.

#### 7.5 Vegetation Clearing

The commencement of vegetation clearing will rely on the completion and sign off of the Form to Permit to Clear Land or Vegetation (Attachment H) by the Environment Manager, as detailed in Section 7.3. If the pre-clearing survey highlighted any biodiversity issues that require further assessment (such as an unexpected threatened species find or the presence of a GHFF camp) then clearing will not commence until this is resolved.

Furthermore, hollow bearing trees and microhabitat features to be translocated will be appropriately marked (using flagging tape, spray-paint or similar) so that they can be readily identified by equipment operators.

Vegetation clearing will adopt the following methodology:

- Vegetation clearing will avoid periods when rain is forecast and will not be undertaken following significant rain that causes overland flow events
- All shrubs and woody vegetation surrounding hollow bearing trees will be cleared no less than 24 hours prior to clearing hollow bearing trees. Note that any tree hollows that are identified once the

tree has been felled (i.e. the hollow entrance was not visible from the ground) should be recorded and incorporated into the monitoring report (see Section 8). The Nest Box Strategy (Attachment F) may require updating following the completion of vegetation clearance to reflect the true number of tree hollows removed

- Marked hollow bearing trees will be felled using the following method:
  - The Project ecologist will complete a visual assessment of the tree for signs of resident fauna
  - Where feasible, hollow sections will be inspected by the project arborist (tree climber) and lowered to the ground (if occupied)
  - Where appropriate, the tree will be nudged by the excavator operator prior to felling and the Project Ecologist will complete another visual assessment
  - Once the Project Ecologist is satisfied, the tree will be felled (either by chainsaw or excavator) ensuring that it does not fall outside of the vegetation clearance boundary. All practical measures will be taken to ensure that the tree falls as slowly as possible
  - Once the operator (chainsaw or excavator) is happy that it is safe for the Project Ecologist to approach the tree, the Project Ecologist will complete a visual assessment of all hollow sections for resident or injured fauna
- Fauna encountered during the clearing activity will be managed in accordance with the flow chart in Section 9.3.

After the completion of clearing, the Post Clearing Inspection Checklist (Attachment K) will be completed to ensure clearance has been undertaken as per approvals.

## 7.6 Site Stabilisation

Following the clearing of vegetation, erosion and sediment control measures or slope stabilisation may need to be implemented, particularly where ground cover vegetation has been removed and bare earth is exposed. The use of erosion and sediment controls/slope stabilisation on cleared land will be determined on an as required basis and will include options such as:

- Hydro-mulching with a sterile perennial grass seed
- Laying of jute matting
- Use of jute rolls to direct surface water
- Installation of sediment fencing
- Mulching with weed free mulch (preferably generated on site during clearing activities)

Erosion and sediment control will be installed in accordance with the erosion and control plan.

The use of these techniques will consider the potential future fuel load and comply with the requirements of the Bushfire Management Strategy.

## 7.7 Management of Noxious Weeds

The presence of noxious weeds to be cleared will be recorded during pre-clearance surveys. The Weed Management Strategy (Attachment E) outlines the framework for managing noxious weeds within the Rail Link project including control and disposal. If other weed management measures are proposed to those listed in the Weed Management Strategy, CPB will seek the advice of appropriately qualified personnel to confirm that the proposal is appropriate.

## 7.8 Compensation for Loss of Fauna Habitat

As discussed in Section 7.3, fauna microhabitat features will be salvaged and translocated into adjoining vegetation to be retained. A total of three hollow bearing trees will be removed by the Project. In order to compensate this loss, a nest box strategy has been developed and is included in Attachment F (Nest Box Strategy).

## 7.9 Biodiversity Offsets

The requirements of Biodiversity Offset Package, including ensuring compliance with CoA C23A, is the responsibility of SIMTA. CPB Contractors will provide the necessary information and inputs to SIMTA to assist them to fulfil the requirements. Any works outside the project footprint as a



requirement of the Biodiversity Offset Package will be undertaken by SIMTA including the rehabilitation of the disused rail spur detailed in CoA C23B.

No clearing is to occur within the Southern Boot land until the requirements of CoA C23A have been satisfied. The Biodiversity Offset Package, required under Co A C23A, shall include the required offset of all impacts arising from the Development, including impacts to *Hibbertia puberula* subsp. *Puberula* and *Hibbertia fumana*.

## 7.10 Mitigation Measures

Mitigation measures for the management of flora and fauna impacts are listed below in Table 12.

Table 12: Mitigation Measures

No.	Control	Timing	Accountability	Source
<b>Site Inductions</b>				
FF1	Site inductions will include a briefing regarding the local threatened flora and native fauna of the site, their significance and protocols to be undertaken if they are encountered in addition to the locations and extents of no-go zones.	Pre-construction	Project Director Construction Manager Environment Manager	FCMM
<b>Pre-clearing</b>				
FF2	The extent of vegetation clearing will be clearly identified on construction plans. Clearly identifying sensitive areas ('no-go areas') which cannot be impacted by construction and managing clearing such that clearing activities are constrained to these approved areas only. Exclusion fencing shall be installed prior to construction to minimise the extent of cleared vegetation.  The width of clearing shall be limited to 20 metres within the riparian corridor of the Georges River and Anzac Creek.	Pre-construction	Project Engineer Environment Manager	FCMM
FF3	Pre-clearance surveys will be completed by the Project Ecologist prior to the commencement of clearing activities for the Rail Link – see section 7.2 for more detail.  Surveys will target, as a minimum, the species listed in Section 5.3, including but not limited to <i>Acacia bynoeana</i> , <i>Grevillea parviflora</i> subsp. <i>parviflora</i> , <i>Hibbertia fumana</i> , <i>Hibbertia puberula</i> subsp. <i>puberula</i> , and <i>Persoonia nutans</i> .	Pre-construction	Project Engineer Environment Manager Project Ecologist	TFSMP
FF4	In circumstances where native vegetation or mature tree clearing is required outside of the biodiversity study area, an ecologist will inspect the proposed area and provide advice on the impact to flora and fauna and appropriate management.  Any additional clearing will need to be justified, require appropriate approval and addressed within the Biodiversity Offset Package if affecting protected vegetation.	Pre-construction	Project Engineer Environment Manager Project Ecologist	FCMM

No.	Control	Timing	Accountability	Source
FF5	An ecologist will undertake pre-clearance surveys to confirm the absence of Grey-headed Flying-fox roosting camps within the Rail link, no more than 48 hours prior to the clearance of vegetation. The DotEE will be notified in writing of the results of pre-clearance surveys. If the species is detected roosting on site, no native vegetation clearance will commence until any directions of the Minister have been complied with.	Pre-construction	Project Engineer Environment Manager Project Ecologist	FCMM
FF6	High visibility plastic fencing is to be installed to clearly define the limits of the works area to not further encroach threatened species. Appropriate warning signage is to be installed along this fencing at regular intervals. See section 7.3 for more details.	Pre-construction	Superintendent Project Engineer Environment Manager Environmental Coordinator	FCMM
FF7	Prior to the commencement of construction the Applicant shall consider the staging of in-water works for the bridge construction across the Georges River to avoid the impact on the migration season of Australian Bass.	Pre-construction	Construction Manager Environment Manager	CoA Project Specific Procedure – Georges River Bridge
FF8	Sensitive areas (no-go areas) which cannot be impacted by construction will be clearly identified. Clearing activities will be constrained to approved areas only.	Pre-construction Construction	Superintendent Project Engineer Environment Manager Environmental Coordinator	RVMP
FF9	The extent of vegetation clearing will be clearly identified on construction plans.	Pre-construction	Superintendent Project Engineer Environment Manager Environmental Coordinator	RVMP
FF10	Instream works at Georges River and Anzac Creek will be minimised as much as possible, including disturbance to aquatic vegetation. Disturbed areas (within the riparian corridors) will be contained to the 20m wide Rail Corridor.	Construction	Superintendent Project Engineer Environment Manager Environmental Coordinator	RVMP
FF11	Fencing of areas of habitat to be retained will be undertaken and individuals of the threatened plant species will be clearly marked in consultation with an ecologist. These areas will be clearly defined as no-go zones for construction activities. See section 7.3 for more details.	Pre-Clearing Clearing	Superintendent Project Engineer Environment Manager Environmental Coordinator Project Ecologist	TFSMP

No.	Control	Timing	Accountability	Source
FF12	Consideration will be given to maintaining the Rail link without fencing during the operation period to minimise impacts to habitat connectivity in the Southern Boot Land.	Detailed Design	Superintendent Project Engineer Environment Manager Environmental Coordinator Project Ecologist	TFSMP
FF13	Options for translocation of individuals removed from the project footprint will be investigated prior to and during construction.  Any translocation will require a licence and must be completed in accordance with (i.e. not conflict with) the Biodiversity Offset Package. Licence will be obtained by the Project Ecologist.	Pre-Clearing Clearing Construction	Superintendent Project Engineer Environment Manager Environmental Coordinator Project Ecologist	TFSMP CoA
FF14	No clearing is to occur for the Rail Link within the Southern Boot Land until the condition C23A (Biodiversity Offset Package) has been satisfied.	Pre-Clearing	Project Director Construction Manager Environment Manager	CoA
<b>Clearing</b>				
FF15	Clearing of vegetation will be timed to avoid periods when rain is forecast in accordance with Chapter 4.4.2 of 'the Blue Book'.	Construction	Superintendent Project Engineer Environment Manager	FCMM RVMP
FF16	Undertake a two-stage approach to clearing: <ul style="list-style-type: none"> <li>Remove non-hollow bearing trees at least 48 hours before habitat trees are removed</li> <li>Hollow bearing trees are to be knocked with an excavator bucket or other machinery to encourage fauna to evacuate the tree immediately prior to felling</li> <li>Felled trees must be left for a short period of time on the ground to give any fauna trapped in the trees an opportunity to escape before further processing of the trees</li> <li>Felled hollow bearing trees must be inspected by an ecologist as soon as possible (not longer than 2 hours after felling)</li> </ul>	Construction	Superintendent Project Engineer Environment Manager Project Ecologist	FCMM
FF17	If any animal is injured, contact the relevant local wildlife rescue agency (e.g. WIRES) and/or veterinary surgery as soon as practical. Minimise stress to the animal and reduce the risk of further injury by: <ul style="list-style-type: none"> <li>Handling fauna with care and as little as possible</li> <li>Covering larger animals with a towel or blanket and placing in a large cardboard box</li> <li>Placing small animals in a cotton bag, tied at the top</li> </ul> Keeping the animal in a quiet, warm, ventilated and dark location.	Construction	Superintendent Project Engineer Environment Manager Environmental Coordinator Project Ecologist	FCMM

No.	Control	Timing	Accountability	Source
FF18	Works within impacted or adjoining areas of land of the rail link within the Southern Bootland, with the potential to impact on <i>Hibbertia puberula</i> subsp. <i>puberula</i> , <i>persoonia nutans</i> and <i>Grevillea parviflora</i> subsp. <i>parviflora</i> will be undertaken in accordance with the Threatened Flora Species Management Plan.	Construction	Superintendent Project Engineer Environment Manager Environmental Coordinator	FCMM
FF19	Seed and other genetic material will be collected from individuals to be removed. Tubestock will be propagated to be replanted in retained areas of habitat, where possible.  This is only to occur in compliance with the Biodiversity Offset Package, which is the responsibility of SIMTA (see section 7.8).	Construction	Superintendent Project Engineer Environment Manager Environmental Coordinator Project Ecologist	TFSMP
FF20	Topsoil and seed bank from occupied habitat areas of threatened species impacted by the Rail link will be retained and reapplied to areas for rehabilitation and/or restoration works once construction is complete.  Stockpiling of topsoil excavated from the Southern Boot Land will be managed to maintain the viability of the seed bank.  This is only to occur in compliance with the Biodiversity Offset Package, which is the responsibility of SIMTA (see section 7.8).	Construction	Superintendent Project Engineer Environment Manager Environmental Coordinator	TFSMP
<b>Vegetation Management</b>				
FF21	Management of noxious weeds will be undertaken in accordance with the <i>Noxious Weeds Act 1993</i> and include details relating to the monitoring, management and where necessary eradication of weeds, disposal of green waste, and vehicle/plant weed wash down protocols if required.	Construction	Superintendent Project Engineer Environmental Coordinator	FCMM
FF22	Soil stripped and stockpiled from areas containing known weed infestations will be stored on cleared land at least 40 m from native vegetation.	Construction	Superintendent Project Engineer	FCMM
FF23	Water from the truck wash down in the Rail East Compound will be captured and disposed of offsite to prevent spread of weed and/or soil pathogens to adjoining native vegetation.	Construction	Superintendent Project Engineer	FCMM
FF24	Management of weeds in and adjacent to cleared areas will occur in accordance with a Weed Management Plan and the <i>Noxious Weeds Act 1993</i> . This plan will include details relating to the monitoring, management and where necessary eradication of weeds, disposal of green waste, and vehicle/plant weed wash down protocols if required.	Construction	Superintendent Project Engineer Environment Manager Environmental Coordinator	C'th MM
FF25	The requirements of the Riparian Vegetation Management Plan and Weed Management Strategy will be implemented as appropriate.	Pre-construction Construction	Environment Manager	C'th MM

No.	Control	Timing	Accountability	Source
FF26	Rehabilitation will commence as soon as practicable where possible.	Construction	Superintendent Project Engineer Environment Manager Environment Coordinator	C'th MM
FF27	Stabilisation of disturbed areas, including revegetation in accordance with the RVMP, will be undertaken as soon as practicable after disturbance.	Construction	Superintendent Project Engineer	C'th MM RVMP
FF28	Seed collection will be undertaken, where possible, at least 12 months prior to the commencement of revegetation. This is only to occur within the Riparian zones of the Georges River and Anzac Creek (not within the Boot Land). It will be carried out by the Bush Regeneration Contractor under supervision by the Project Ecologist and the Environment Manager.	Pre-construction Construction Ongoing	Superintendent Project Engineer Environment Manager Environment Coordinator Project Ecologist	RVMP
FF29	Tubestock will be propagated from collected seed. This is only to occur within the Riparian zones of the Georges River and Anzac Creek (not within the Boot Land). It will be carried out by the Bush Regeneration Contractor under supervision by the Project Ecologist and the Environment Manager.	Pre-construction Construction Ongoing	Environment Manager Environment Coordinator Project Ecologist	RVMP
FF30	Planting and direct seeding in areas of retained vegetation will be undertaken after the completion of primary weed control works.  This is only to occur within the Riparian zones of the Georges River and Anzac Creek (not within the Boot Land). It will be carried out by the Bush Regeneration Contractor under supervision by the Project Ecologist and the Environment Manager.	Construction	Superintendent Project Engineer Environment Manager Environment Coordinator Project Ecologist	RVMP
FF31	Where possible, topsoil in the riparian areas removed for the Proposal will be reused for revegetation. This will only occur if the following conditions are met: <ul style="list-style-type: none"> <li>Topsoil is sourced from an area with low weed density</li> <li>Topsoil will only be reused for re-vegetation of the same PCT as its source</li> </ul>	Construction	Superintendent Project Engineer Environment Manager Environment Coordinator	RVMP
FF32	Riparian areas that are temporarily cleared for construction adjoining the Georges River will be revegetated as soon as practicable upon completion of bridge works.	Construction Ongoing	Superintendent Project Engineer Environment Manager Environment Coordinator	RVMP
FF33	The 20m wide Rail link will be stabilised following construction with local topsoil with growth of groundcover encouraged. The corridor will be managed by removing weeds and reducing the fuel load.	Construction	Superintendent Project Engineer Environment Manager Environment Coordinator	RVMP

No.	Control	Timing	Accountability	Source
FF34	Primary weed control, removal of dense weed cover, of the management sites will be undertaken throughout construction, including the pre-clearing stages.	Pre-construction Construction Ongoing	Superintendent Project Engineer Environment Manager Environment Coordinator Project Ecologist	RVMP
FF35	Follow up inspections and weed control will be undertaken to continue to suppress weeds in management sites.	Construction Ongoing	Superintendent Project Engineer Environment Manager Environment Coordinator Project Ecologist	RVMP
FF36	Management of noxious weeds will be undertaken in accordance with the <i>Noxious Weeds Act 1993</i> .	Pre-construction Construction Ongoing	Superintendent Project Engineer Environment Manager Environment Coordinator	RVMP
FF37	Equipment used for treating weed infestation will be cleaned prior to moving to a new area within the management site to minimise the likelihood of transferring any plant material and soil.	Pre-construction Construction Ongoing	Superintendent Project Engineer	RVMP
FF38	Soil stripped and stockpiled from areas containing known weed infestations will be stored on cleared land at least 40 m from native vegetation.	Construction	Superintendent Project Engineer	RVMP
FF39	Soil excavated from the Anzac Creek corridor will be disposed of in accordance with the guidelines in the Alligator Weed Control Manual (DPI 2007), as it will likely contain fragments of Alligator Weed.	Construction	Superintendent Project Engineer Environment Manager Environment Coordinator	RVMP
FF40	A population census and ongoing population monitoring of threatened species will be undertaken within the Southern Boot Land offset site, as part of the project's Biodiversity Offset Package.  This is only to occur in compliance with the Biodiversity Offset Package, which is the responsibility of SIMTA (see section 7.8).	Construction	Environment Manager Environment Coordinator Project Ecologist SIMTA	TF SMP
FF41	The health of threatened species populations within the Southern Boot Land offset site will be inspected, by checking plant sizes, flowering and extents against the benchmarks described in Section 3 of the Threatened Flora Species Management Plan, as part of the project's Biodiversity Offset Package.  This is only to occur in compliance with the Biodiversity Offset Package, which is the responsibility of SIMTA (see section 7.8).	Construction	Environment Manager Environment Coordinator Project Ecologist SIMTA	TF SMP

No.	Control	Timing	Accountability	Source
FF42	Weeds in the Southern Boot Land offset site will be monitored and weed removal will be undertaken by hand in areas of threatened species habitat, as part of the projects Biodiversity Offset Package.  This is in relation to areas beyond the Anzac Creek bushland regeneration footprint and only to occur in compliance with the Biodiversity Offset Package, which is the responsibility of SIMTA (see section 7.8).	Pre-construction Construction	Environment Manager Environment Coordinator Project Ecologist SIMTA	TFSMP
FF43	Fencing around the perimeter of the Southern Boot Land will be checked and maintained regularly.  Fencing beyond what is required or installed as part of the Rail Link project is the responsibility of SIMTA.	Construction	Superintendent Project Engineer Environment Manager Environment Coordinator	TFSMP
FF44	The response of <i>Hibbertia puberula</i> subsp. <i>puberula</i> , <i>Persoonia nutans</i> and <i>Grevillea parviflora</i> subsp. <i>parviflora</i> to disturbance measures within the impacted and adjoining areas of land of the rail link will be monitored.	Construction	Environment Manager Environment Coordinator Project Ecologist	TFSMP
FF45	Large shrubs will be selectively removed to encourage expansion of <i>Hibbertia puberula</i> subsp. <i>puberula</i> , <i>Persoonia nutans</i> and <i>Grevillea parviflora</i> subsp. <i>parviflora</i> population on edge habitats (edges of woodland) and in areas of suitable habitat in impacted and adjoining areas of the rail link, as part of the projects Biodiversity Offset Package.  This is only to occur in compliance with the Biodiversity Offset Package, which is the responsibility of SIMTA (see section 7.8).	Construction	Superintendent Project Engineer Environment Manager Environment Coordinator Project Ecologist SIMTA	TFSMP
FF46	Checks of erosion and sediment controls and water quality management measures across the Southern Boot Land and adjacent areas / upslope areas will be undertaken on a regular basis.	Construction	Superintendent Project Engineer Environment Manager Environment Coordinator	TFSMP
<b>Protection of Fauna Habitat</b>				
FF47	A nest box management strategy has been prepared and will be implemented prior to the commencement of clearing for construction.	Pre-construction	Environment Manager Environment Coordinator Project Ecologist	FCMM
FF48	Fauna microhabitat such as logs will be removed from areas to be cleared and relocated to suitable nearby bushland areas in the presence of an ecologist.	Construction	Superintendent Project Engineer Environment Manager Environment Coordinator Project Ecologist	FCMM



No.	Control	Timing	Accountability	Source
FF49	If any pits/trenches are to remain open overnight, they will be securely covered, if possible. Alternatively, fauna ramps (logs or wooden planks) are to be installed to provide an escape for trapped fauna.	Construction	Superintendent Project Engineer Environment Manager Environment Coordinator Project Ecologist	FCMM
FF50	Large woody debris will be retained in watercourses where possible. In the event large woody debris are to be impacted they will be relocated in consultation with an ecologist.	Construction	Superintendent Project Engineer Environment Manager Environment Coordinator Project Ecologist	RVMP
<b>Protection of Aquatic and Riparian Habitat</b>				
FF51	Works areas at each watercourse crossing will be clearly delineated prior to commencement of works.	Preconstruction	Superintendent Project Engineer Environment Manager	FCMM
FF52	Large woody debris will be retained in watercourses where possible. In the event large woody debris are to be impacted they will be relocated in consultation with an ecologist.	Pre-construction	Superintendent Project Engineer Project Ecologist	FCMM
FF53	Riparian vegetation within the Rail link and adjoining areas of impact at Anzac Creek and the banks of the Georges River will be protected, rehabilitated and managed in accordance with the measures detailed in the Riparian Vegetation Management Plan.	Pre-construction, construction and post construction	Superintendent Project Engineer Environment Manager Environment Coordinator	FCMM
FF54	Temporarily disturbed riparian areas in the Georges River will be revegetated with locally occurring native species as soon as practicable upon completion of bridge works.	Construction	Superintendent Project Engineer Environment Manager Project Ecologist	FCMM
FF55	Water quality and macroinvertebrate monitoring will be undertaken up and downstream of works within the Georges River and Anzac Creek, pre, during and post construction, to determine impacts on aquatic communities as a result of the Project. The monitoring plan will be developed and implemented by an appropriately qualified aquatic ecologist.	Pre-construction, construction and post construction	Environment Manager Environmental Coordinator Project Ecologist	FCMM
FF56	A visual inspection of the Georges River for dead or distressed fish (indicated by fish gasping at the water surface, or fish crowding at the creek's banks) will be undertaken daily during the construction of the Georges River bridge. Observations of dead or distressed fish will be immediately reported to DPI (Fisheries). In the event dead or distressed fish are found, all works will cease until the issue is rectified and approval from DPI Fisheries is given to proceed.	Construction	Superintendent Project Engineer Environment Manager Environmental Coordinator	FCMM

No.	Control	Timing	Accountability	Source
FF57	Appropriate drainage infrastructure (e.g. sediment basins, diversion drains), sediment and erosion controls will be installed prior to the commencement of construction.	Pre-construction	Superintendent Project Engineer Environment Manager Environmental Coordinator	C'th MM RVMP
FF58	Clearing of vegetation will not be undertaken during overland flow events.	Construction	Superintendent Project Engineer	C'th MM
FF59	Soil and mulch stockpiles will be located away from watercourses and key stormwater flow paths to limit potential transport of these substances into the watercourses via runoff.	Construction	Superintendent Project Engineer	C'th MM RVMP
FF60	Design and construction of rail crossings over Anzac Creek and Georges River will be in accordance with Fish Passage Requirements for Waterway Crossings (Fairfull and Witheridge 2003).	Planning	Engineering Manager Construction Manager Superintendent Project Engineer	C'th MM
FF61	Landscaped zones will be installed to capture gross pollutants and oil and grits from pavement. These areas will be regularly maintained to remove rubbish and will be renewed on a regular basis.	Construction	Superintendent Project Engineer	C'th MM
FF62	Bio-retention will be installed in base of channels and swales proposed to capture and store stormwater. This will consist of bio-filtration layers, planting and subsoil collection and drainage.	Pre-construction	Superintendent Project Engineer	C'th MM
<b>General</b>				
FF63	Pre start-up checks of all infrastructure, plant and equipment and/or relocation of stored construction materials will be undertaken for sheltering native fauna.	Construction	Superintendent Project Engineer Environment Manager	FCMM
FF64	Directional lighting will be used where lighting is required in construction areas.	Construction	Superintendent Project Engineer	FCMM
FF65	Dust suppression activities will be undertaken where appropriate.	Construction	Superintendent Project Engineer	C'th MM RVMP
FF66	Frequent maintenance of construction machinery and plant will be undertaken to minimise unnecessary noise.	Construction	Superintendent Project Engineer	C'th MM
FF67	Speed limits will be developed so as to minimise the potential for fauna to be struck by a vehicle within the SIMTA site. All vehicles and plant in operation on the SIMTA site are to adhere to site rules relating to speed limits.	Construction	Project Director Construction Manager Superintendent Project Engineer Environment Manager	C'th MM

No.	Control	Timing	Accountability	Source
<b>CPB Contractors Mandatory Minimum Requirements</b>				
FF68	<p>Prior to any disturbance, clearing or grubbing activities in any locations the following will be in place;</p> <ul style="list-style-type: none"> <li>■ A Land Disturbance Permit (or equivalent)</li> <li>■ No-go Zones for significant flora and fauna must be established, fenced/flagged and sign posted prior to commencement of clearing</li> <li>■ The Project Ecologist needs to conduct a search for any wildlife that may need to be removed and relocated</li> </ul> <p>The Vegetation Clearing Procedure will be followed for any clearing.</p>	Pre-construction	<p>Construction Manager</p> <p>Project Engineer</p> <p>Environment Manager</p> <p>Environment Coordinator</p> <p>Project Ecologist</p>	CPB Contractors Mandatory Minimum
FF69	If a threat to an animal is evident onsite, the supervisor and/or the Environment Manager will be contacted immediately. Works may need to cease if the animal is in danger or harmed until it has been relocated.	Construction	<p>Superintendent</p> <p>Project Engineer</p> <p>Environment Manager</p>	CPB Contractors Mandatory Minimum
FF70	The site speed limits will be obeyed at all times, especially areas where vehicle/fauna interactions are identified as high risk.	Construction	<p>Construction Manager</p> <p>Superintendent</p> <p>Project Engineer</p>	CPB Contractors Mandatory Minimum
FF71	All plant will remain on haul roads as much as possible so as to minimise damage to vegetation.	Construction	<p>Construction Manager</p> <p>Superintendent</p> <p>Project Engineer</p>	CPB Contractors Mandatory Minimum
FF72	No-go zones will be obeyed at all times without a Permit to Enter No-go Zone. Any damage to no-go zone fencing or signage will be reported to your supervisor or the Environment Manager immediately.	Construction	<p>Construction Manager</p> <p>Superintendent</p> <p>Project Engineer</p> <p>Environment Manager</p>	CPB Contractors Mandatory Minimum
FF73	Cleared/removed vegetation will be beneficially used either on or off the project where possible (e.g. for habitat, chipped for mulch and reused).	Construction	<p>Superintendent</p> <p>Project Engineer</p>	CPB Contractors Mandatory Minimum
FF74	Where possible revegetation activities will preferentially use only species that are indigenous to the area.	Construction	<p>Superintendent</p> <p>Project Engineer</p> <p>Environment Manager</p>	CPB Contractors Mandatory Minimum
FF75	Boundaries of allowable disturbance areas on the project will be clearly marked and delineated.	Pre-construction	<p>Construction Manager</p> <p>Superintendent</p> <p>Project Engineer</p> <p>Environment Manager</p>	CPB Contractors Mandatory Minimum
FF76	Training will be provided to staff on the prevention of fires and spills within protected bushland and incident management if an event was to occur.	Construction	Environment Manager	Good practice

## 7.11 Riparian Vegetation Management

In accordance with FCMM #8B, riparian vegetation within the foot print of the rail link and adjoining areas of impact along the banks of Anzac Creek and the Georges River will be protected, rehabilitated and managed in accordance with the Riparian Vegetation Management Plan (Appendix I to the Biodiversity Assessment Report, Appendix J to the Response to Submissions). The Riparian Vegetation Management Plan (RVMP) has been included as Attachment M to the CFFMP.

In accordance with the Hyder RVMP, a separate more detailed RVMP will be developed by a qualified Ecologist. This updated RVMP will be developed to comply with the objectives / outcomes of the Hyder RVMP, include site specific guidance related to the criteria listed in the Hyder RVMP and based on the *Guidelines for Vegetation Management Plans on Waterfront Land (NOW, 2012)*. The work outlined in this updated RVMP will provide a framework for the work to be undertaken by an experience bush regeneration contractor. If updates are required to the updated RVMP, they will be reviewed and accepted by the qualified Ecologist in accordance with the requirements of the Hyder RVMP.

All work by the bush regeneration contractor will be undertaken in accordance with the updated RVMP, with guidance and monitoring undertaken by the Ecologist to confirm compliance with the objectives and outcomes of the RVMP.

## 8. Review and Improvement

### 8.1 Inspections and Monitoring

Inspections, observations, and monitoring requirements relevant to the management of flora and fauna are identified in Table 13.

Table 13: General Monitoring Requirements Relating to Flora and Fauna

Monitoring Activity	Frequency	Standard	Responsibility
<b>Inspections</b>			
Pre-clearance survey	As required prior to clearing	Surveys will be conducted in accordance with Section 7.3	Environment Manager Site Supervisor
Flora Translocation	As required prior to clearing	Confirmation of translocation viability and commitment. In addition to previous surveys as detailed in the BAR and Hibbertia Species Survey Plan, surveys will be conducted in accordance with Section 7.3	Environment Manager Project Ecologist SIMTA's Ecologist
Weed mapping	As required prior to clearing	Surveys will be conducted in accordance with Section 7.3	Environment Manager Site Supervisor
Inspection of clearance boundaries	Daily during clearing activities and weekly during construction.	Surveys of vegetation clearing boundaries to ensure that high visibility fencing and signage is in good order	Environmental Coordinator
Threatened Flora and Fauna	As required during clearing and construction activities	Any unexpected threatened species of ecological communities finds will be reported in accordance with Section 9.2	Project Ecologist Environmental Coordinator
Fauna capture and relocation	As required during clearing and construction activities	Records of any non-threatened fauna that is handled during clearing and general construction activities will be kept	Environment Manager Site Supervisor
Bush Regeneration Inspections	As required during construction and post construction	Inspections will be in accordance with the requirements outlined in Section 7.10	Project Ecologist Bushland Regeneration Contractor
A visual inspection of the Georges River for dead or distressed fish	Daily during construction of the Georges River bridge	Signs of dead or distressed fish (such as fish gasping at the water surface, or fish crowding at the creek's banks) will be recorded in accordance with Section 0	Environment Manager Site Supervisor
<b>Monitoring</b>			
Specific Monitoring Programs	As required by the: <ul style="list-style-type: none"> <li>Threatened Flora Species Management Plan (Response to Submission – Appendix J: Biodiversity Assessment Report – Appendix A)</li> <li>Riparian Vegetation Management Plan (Response to Submission – Appendix J: Biodiversity Assessment Report – Appendix I)</li> <li>Weed Management Strategy (Refer to section 7.1 of WMS)</li> <li>Nest Box Management Strategy (Refer to section 5 of the NBMS)</li> <li>Aquatic Ecology Monitoring Plan (Refer to section 6 of the AEMP)</li> </ul> These will be incorporated into the relevant work packs and Site Environmental Plans as required.		

Monitoring Activity	Frequency	Standard	Responsibility
Non-conformance within the construction areas of the Rail Link Project	As required, during weekly inspections	CEMP including CFFMP and associated sub plans	Environment Manager Site Supervisor

## 8.2 Reporting

Reporting will be completed in connection with monitoring activities in Table 13 and in accordance with the reporting program in Table 14.

Table 14: Flora and Fauna Reporting Program

Item	Frequency	Standards	Responsibility
Pre-construction			
Pre-clearance reports	Following the completion of clearance activities or annually	The Project Ecologist will report on the results of pre-clearing surveys to CPB Contractors prior to clearing works commencing.  This would be issued to the project team, with the details of this report to be used for input into relevant project documentation, such as sensitive area mapping, SEPs, and Nest Box Management Strategy.	Environment Manager Project Ecologist Project Arborist (as required)
Fauna observations, included injured, handled and euthanised fauna	Following the completion of clearance activities or annually	The Project Ecologist will report on the findings or observations	Environment Manager Project Ecologist
Unexpected threatened species finds report	As required	The Environment Manager will report on any unexpected species finds during construction and pre-clearance surveys.	Environment Manager
During construction and post-construction			
Specific reporting	As required by the: <ul style="list-style-type: none"><li>■ Weed Management Strategy</li><li>■ Nest Box Management Strategy</li><li>■ Aquatic Ecology Monitoring Plan</li><li>■ Riparian Vegetation Management Plan</li></ul> These will be incorporated into the relevant work packs and Site Environmental Plans as required.		Environment Manager Project Ecologist Bushland Contractor

A more comprehensive report will be prepared to document the outcomes of the pre-clearance surveys and any baseline data, including:

- Any variations to the mapped boundaries of threatened ecological communities
- Final number of all threatened species, including but not limited to *Hibbertia puberula* subsp. *puberula*, *Hibbertia Fumana*, *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora*, that were cleared
- Locations of any additional threatened species identified
- Locations of any additional records of previously identified threatened species
- The details of any GHFF roosting camps that were recorded
- Details of any fauna relocations, injuries or fatalities
- The final number of hollow bearing trees (and details of the tree hollows) that were removed during vegetation clearance
- Details of any fauna microhabitat that was salvaged and the location that it was translocated to
- Mapping of noxious weeds that were recorded

The monitoring reports will be provided to the Department of Planning and Environment, Department of the Environment and Energy (Commonwealth) and Department of Primary Industries – Fishing and Aquaculture (as required or requested).



### 8.3 Auditing and Update

Audits will be undertaken to assess the effectiveness of environmental safeguards and controls, ensure compliance with the CEMP (including the CFFMP), Commonwealth and State issued conditions of approval, and applicable licenses and guidelines.

As per Part B – Element 12 of the CEMP, the CFFMP will be reviewed every 6 months to ensure it is applicable to works on site. Any updates to the CFFMP will be in accordance with the criteria set out in the CEMP.

Further details regarding the Rail Link project audit requirements are detailed in the CEMP.

### 8.4 Continuous Improvement

Continuous improvement of this plan will be achieved by amending the proposed actions based on the results of monitoring and audits.

The process that will be implemented to ensure continuous improvement will be both proactive and reactive and include:

- Identification of opportunities to adapt management measures for the longer term viability and success of native vegetation adjoining the rail easement.
- Identification of opportunities to improve performance including (such as modifications to site inductions, retention of biodiversity where possible)
- Refining the content of the site induction as required
- Promoting a no blame attitude and encouraging reporting of environmental issues
- Determining the cause of non-compliances and developing corrective and preventative actions to avoid future problems
- Consultation with stakeholders prior to implementing any major modifications
- Ongoing monitoring and auditing to ensure modification provide long term improvement.

## 9. Incident Response

During pre-construction and construction activities, unexpected incidents may occur that have the potential to cause additional impacts to flora and fauna. A framework for managing and responding to these incidents is provided below.

### 9.1 Inadvertent Additional Clearing

If it is identified that additional clearing has been undertaken outside of the approved clearing boundary, work should stop immediately. The Environment Manager shall determine the potential risks associated with the additional clearing based on the Sensitive Area Maps (Attachment C) and determine the likely additional assessment that is required. If required, the project ecologist will undertake an assessment to determine the likely consequence and significance of the additional clearing. If it is identified that significant clearing has occurred outside of assessed boundaries without approval, it would be raised as an Incident of actual or potential significance to DP&E as required through CoA condition E10.

This would include a determination of whether the project is consistent with the existing approvals documents and outline the requirement for notification and further consultation with SIMTA, the Department of the Environment and Energy (Commonwealth), the Department of Planning and Environment and the Office of Environment and Heritage.

### 9.2 Unexpected Threatened Species

The sensitive area maps (Attachment C) highlight the existing flora and fauna values that are known to occur within the study area. During pre-clearance assessments and marking of vegetation clearance boundaries it is possible that additional threatened species may be identified. If unexpected threatened species are identified during pre-clearing surveys, they must be documented and their locations recorded. If potential impacts are uncovered, additional assessment will be required and any appropriate approvals, safeguards and mitigation measures determined.

This assessment process will involve consultation with SIMTA, the Department of the Environment and Energy (Commonwealth), the Department of Planning and Environment and the Office of Environment and Heritage. Further assessment beyond the immediate extent of clearing may be required in order to determine the significance of potential impacts. The outcome of the impact assessment will be a list of appropriate mitigation measures that will be implemented to minimise the impacts of the Rail Link project. Subsequent modifications of the monitoring and biodiversity offset requirements may be required.

A flow chart depicting the process to be implemented is provided in Figure 44 below.

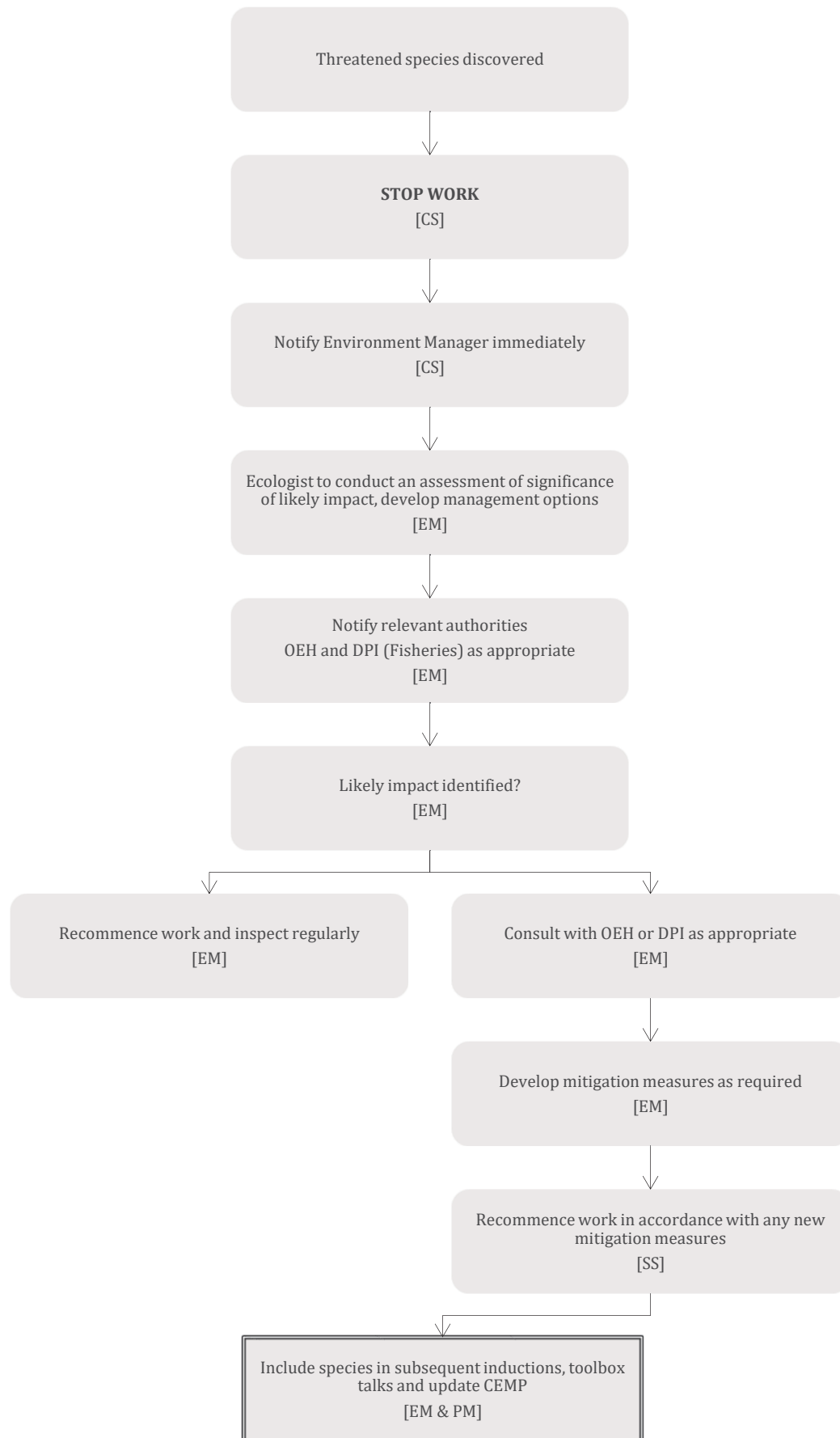


Figure 4: Unexpected Threatened Species Find Flow Chart

### 9.3 Fauna Capture and Relocation

During vegetation clearing and general construction activities it is likely that non-threatened fauna will be encountered. An escalation flow chart depicting the framework for managing fauna encounters is provided below in Figure 5 and specific techniques for interim management of various animal types is provided in Table 15.

The position of fauna handler, outlined in the escalation flow chart may be one of a number of people. If vegetation clearing is being undertaken then the project ecologist would adopt the role of fauna handler. In other scenarios, where vegetation clearing is not being undertaken, the Environmental Coordinator will mobilise an appropriate person to adopt the role. All injured fauna must be transported to a local vet for assessment and treatment. If nobody on site is sufficiently experienced to capture and transport an injured animal to the vet then the Project Ecologist will be contacted immediately and attend to the situation. Vulnerable fauna that are not injured or nocturnal fauna that are displaced during the day may require some rehabilitation from a qualified wildlife carer. In this instance WIRES would be contacted to find an appropriate wildlife carer to handle the fauna. Contact details for relevant local services are provided in Table 16.

Table 15: Handling Details for Various Animal Types

Animal Type	Handling Details
Mammals and birds	Small mammals and birds should be placed into a cotton sack (or similar) inside a larger, well ventilated box. A transporter box may be more suitable for larger animals, particularly possums which can be wrapped in a towel or blanked and placed inside. These carries should then be placed somewhere warm and quiet, out of direct sunlight, in preparation for transporting to a vet or nearby release.
Microbats	Anyone attempting to handle bats should be vaccinated against the Australian Bat Lyssavirus and wearing heavy duty hand protection (such as leather gloves).
Frogs	Handling of frogs will be undertaken in accordance with the <i>DECC Hygiene Protocol for Control of Disease in Frogs</i> (DECC 2008) to minimise the risk of spreading Amphibian Chytrid Fungus.
Reptiles	Handling of snake species should only be carried out by qualified people that are licenced to catch and release reptiles. Licensed handlers and be contacted using the OEH Reptile Handler list (see below), non-venomous reptiles can be placed inside a cotton sack for transportation to a vet or in preparation for nearby release. Injured reptiles should be kept in a cool location and not purposefully warmed up as this can increase the level of discomfort. See <a href="http://www.environment.nsw.gov.au/resources/wildlifelicences/reptilehandlerlist.pdf">http://www.environment.nsw.gov.au/resources/wildlifelicences/reptilehandlerlist.pdf</a> .
Fish and aquatic species	Fish can be placed in an aquarium or plastic bag with sufficient amount of water. Ensure sufficient water and adequate aeration
Relocation and release	Captured animals will, where possible, be released immediately into suitable habitat, away from ongoing clearing activities. If required, species may be held temporarily, until such habitat is available. Held animals must be placed in suitable receptacles and cared for by an experienced wildlife carer. Nocturnal animals captured during diurnal activities shall be held until dusk and released into appropriate vegetation. The Project Ecologist will identify a suitable potential release site prior to clearing habitat trees.
Injured animals	Injured animals will be transported for immediate veterinary care. Following this care, they may be transferred to a local animal welfare groups.
Euthanasia	Terminally injured native species and pest animal species may need to be euthanised. Any euthanasia must be completed by a competent person and use accepted, humane techniques (i.e. cervical dislocation for small mammals and ice slurry for introduced fish). If no such person is available, the injured native animal should be transferred to the nearest veterinary clinic immediately.

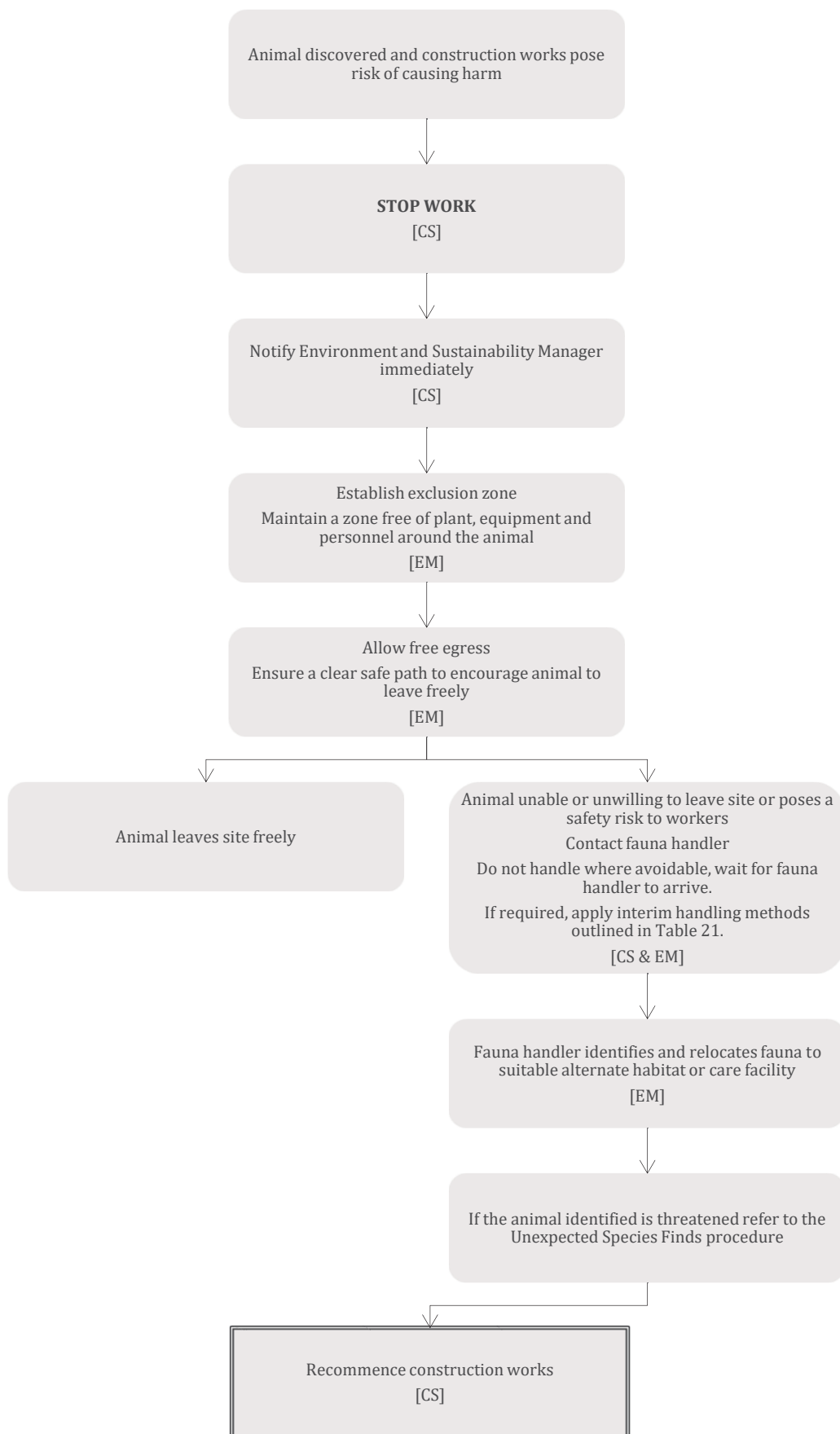


Figure 5: Fauna Management Flow Chart

Table 16: Fauna Welfare Contacts

Service	Name	Contact Details
Veterinary clinic	Liverpool Veterinary Hospital	329 Hume Hwy, Liverpool NSW 2170 (02) 9602 6015
	Newbridge Animal Centre	1/1 Field Cl, Moorebank NSW 2170 (02) 9601 0000
	Moorebank Veterinary Hospital	35 Stockton Ave, Liverpool NSW 2170 (02) 8798 4859
Wildlife rescue/carer	WIRES	1300 094 737
Snake handling	Various for Sydney Metro	<a href="http://www.environment.nsw.gov.au/resources/wildlifelicences/reptilehandlerlist.pdf">http://www.environment.nsw.gov.au/resources/wildlifelicences/reptilehandlerlist.pdf</a>

#### 9.4 Fish Mortality

During construction of the Georges River Bridge, a daily visual inspection for dead or distressed fish will be completed. Symptoms of fish distress include, but are not limited to: gasping at the water surface, crowding of fish at the creek's banks, floating or rolling at the surface or excessive thrashing in shallow water. If such symptoms are noted, or dead fish are observed, works are to cease until the issue is rectified and approval to proceed is provided by DPI Fisheries.

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## Attachments

### Attachment A: Compliance Matrix

#### Contract Clauses

There are no specific contract clauses or which set limits and/or govern impacts to flora and fauna on the Rail Link project.

#### Conditions of Project Environmental Approvals

Conditions of approval that specifically address the management of flora and fauna are identified in Table 17 to Table 22 below.

#### Stage 1 Conditions of Approvals

Table 17: Stage 1 Conditions of Approval

Stage 1 CoA Ref	Requirement	Where Addressed
C10	Prior to the commencement of construction the Applicant shall consider the staging of in-water works for the bridge construction across the Georges River to avoid the impact on the migration season of Australian Bass.	Construction Management Plan PSP – Georges River Bridge
C11	Prior to the commencement of the bridge construction works across the Georges River, the Applicant must consider if possible, restricting the use of the temporary platform to only one, and be designed to maintain fish passage. The Applicant must consult with Fisheries NSW with regard to the platform and its design prior to constructing the platform in the Georges River.	PSP – Georges River Bridge Design Report
C12	The Applicant is to ensure that a daily visual inspection for dead or distressed fish in the Georges River is undertaken. Fish distress is indicated by fish gasping at the water surface, or crowding at the creek's banks. Should dead or distressed fish be observed, all works are to cease and NSW Fisheries is to be contacted immediately. Works can proceed following approval by NSW Fisheries.	Table 12 Section 8.1 Section 0 PSP – Georges River Bridge
C20	The Applicant shall ensure the width of the rail link corridor is no greater than 20 metres in the Riparian corridor of the Georges River and Anzac Creek.	Table 12
C21	The Georges River Bridge shall be designed to ensure fauna movement within the riparian corridor is maintained. The bridge shall be designed in consultation with DPI Water and approved by the Certifying Authority. A copy of the final design shall be submitted to the Secretary for information and made available on the Project Website.	Design Report SIMTA website
C22	The Applicant shall prepare and implement a 'Threatened Dragonfly Species survey Plan' to determine the presence or absence of threatened dragonfly species listed under the <i>Fisheries Management Act 1994</i> on the Georges River, adjacent to the development site. The plan, including survey methodology, shall be prepared in consultation with DPI Fisheries prior to the commencement of construction.  On implementing the plan, the survey results are to be forwarded onto DPI Fisheries. Should threatened dragonfly species be found at the site, DPI Fisheries should be contacted to agree on possible mitigation measures to avoid impacts in accordance with <i>NSW DPI Policy and Guidelines for Fish Habitat Conservation and Management</i> (2013).	Section 6.4 Attachment L:Threatened Dragonfly Species Survey Plan Report (Arcadis, September 2016)

## Attachments

Stage 1 CoA Ref	Requirement	Where Addressed
C23	Prior to the commencement of clearing within the railway corridor between the southern boundary of the terminal site and the eastern side of the approved Moorebank Avenue Bridge, the Applicant must prepare and implement a Hibbertia Species Survey Plan to determine the number of individual plants of each Hibbertia species present within the corridor and confirm that the required quantum of biodiversity offset credits needed to provide an offset for the surveyed number of individual plants of each Hibbertia species can be achieved. The survey plan, including the survey method, must be prepared in consultation with OEH to the satisfaction of the Secretary. Results of the survey must be included in the Biodiversity Offset Package required by C23A.	Section 7.3 Attachment J
C23A	<p>Prior to the commencement of clearing within the rail corridor between the southern boundary of the terminal site and the eastern side of the approved Moorebank Avenue Bridge, the Applicant shall develop and implement a Biodiversity Offset Package to the satisfaction of the Secretary. The Package shall detail how the ecological values lost as a result of the SSD will be offset. The Package shall be consistent with the NSW Biodiversity Offsets Policy for Major Projects (OEH 2014), unless otherwise agreed by the Secretary.</p> <p>The Package shall include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> <li>(a) the identification of the extent and types of habitat that would be lost or degraded as a result of the final design of the SSD;</li> <li>(b) the objectives and biodiversity outcomes to be achieved;</li> <li>(c) the final suite of the biodiversity offset measures selected and secured in consultation with OEH;</li> <li>(d) the management and monitoring requirements for compensatory habitat works and other biodiversity offset measures proposed to ensure the outcomes of the package are achieved, including:</li> <li>(e) the monitoring of the condition of species and ecological communities at offset (including translocation) locations;</li> <li>(f) the methodology for the monitoring program(s), including the number and location of offset monitoring sites, and the sampling frequency at these sites;</li> <li>(g) provisions for the annual reporting of the monitoring results for a set period of time as determined in consultation with the OEH; and</li> <li>(h) timing and responsibilities for the implementation of the provisions of the Package.</li> </ul> <p>The Approved Biodiversity Offset Package shall be published on the Project Website within 7 days of its approval.</p> <p>Where land offsets cannot solely achieve compensation for the loss of habitat, additional measures shall be provided to collectively deliver an improved or maintained biodiversity outcome for the region.</p> <p>Where monitoring referred to in (e) above indicates that biodiversity outcomes are not being achieved, remedial actions shall be undertaken to ensure that the objectives of the Biodiversity Offset Package are achieved to the satisfaction of the Secretary. Such remedial actions shall be documented under an addendum to the Biodiversity Offset Package and the addendum be submitted to the satisfaction of the Secretary, prior to the implementation of that addendum.</p> <p>If the applicant can demonstrate to the satisfaction of the Secretary that the proposed offset land for between the southern boundary of the terminal site and the eastern side of the approved Moorebank Avenue Bridge has been secured, the Applicant shall within 12 months of the commencement of construction develop and</p>	<p>Biodiversity offsets are outside of CPB's scope. This will be managed by SIMTA, with CPB providing information as required.</p> <p>Section 7.9.</p> <p>No clearing within Southern Boot Land until Condition C23A is satisfied or part thereof.</p>

## Attachments

Stage 1 CoA Ref	Requirement	Where Addressed
	<p>implement the Biodiversity Offset Package to the satisfaction of the Secretary in accordance with items (a)-(h) above.</p> <p>Note: Where the Applicant has opted to develop a consolidated Biodiversity Offset Package covering both the Moorebank Intermodal Terminal (SSD 5066) and SIMTA sites, this must be submitted to the Secretary within 12 months of submitting the initial Biodiversity Offset Package in accordance with this condition, unless otherwise agreed by the Secretary.</p>	
C23B	<p>The Applicant shall:</p> <ul style="list-style-type: none"> <li>a) remove the disused rail spur traversing the Southern Boot Land and remediate and rehabilitate the land containing the disused rail spur traversing the Southern Boot Land, which is identified in blue dotted outline on Attachment A to these conditions titled "Figure 1 - Wattle Grove Offset Area"; and</li> <li>b) once remediation of the disused rail spur is complete, apply within 2 months of completion of the remediation to amend the biobanking agreement to incorporate the land shaded yellow on Attachment A to these conditions titled "Figure 1 - Wattle Grove Offset Area"; and</li> <li>c) apply within 2 months of the issue of the biobanking agreement to amend the biobanking agreement to incorporate the land shaded red on Attachment A to these conditions titled "Figure 1 - Wattle Grove Offset Area".</li> </ul> <p>Nothing in this condition requires the Applicant to amend the biobanking agreement application lodged with OEH in February 2017.</p>	Removal and rehabilitation of the rail spur is outside of CPB's scope. This will be managed by SIMTA.
E31	No threatened species or communities can be cleared other than that required for construction.	Section 4
E31A	Where any threatened flora species are to be cleared, individual plants of species suitable for translocation shall be considered for translocation into areas that have been identified as requiring rehabilitation within the Biodiversity Offset Package.	Section 7.2
E32	The existing mature trees located on the eastern side of Moorebank Avenue shown on Drawing LA01 (Landscape Masterplan) dated 30.3.2015 shall be retained, unless where required to be removed for construction of a permanent access point to the terminal site. Trees to be retained shall be protected and maintained during preconstruction and construction activities in accordance with AS4970-2009 Protection of trees on development sites. Details of tree protection must be provided to the Certifying Authority prior to the commencement of construction.	Not applicable to RALP Stage 1 Works – responsibility of SIMTA
E34 d (i)	<p>A <b>Construction Flora and Fauna Management Plan</b> to detail how impacts on ecology (as detailed in the most recent mapping endorsed by OEH) will be minimised and managed. The Plan shall be developed by a suitably qualified and experienced ecologist and in consultation with the OEH and DPI, and shall include, but not necessarily be limited to:</p> <p>(i) plans for impacted and adjoining areas showing vegetation communities; important flora and fauna habitat areas; locations where threatened species, populations or ecological communities have been recorded; including pre-clearing surveys to confirm the location of threatened flora and fauna species and associated habitat features;</p>	<p>This Plan Consultation addressed in Section 3.1 and Attachment D</p> <p>Attachment C</p>
E34 d (ii)	The identification of areas to be cleared and details of management measures to avoid residual habitat damage or loss and to minimise or eliminate time lags between the removal and subsequent replacement of habitat such as:	Attachment C Section 7.4

**Attachments**

Stage 1 CoA Ref	Requirement	Where Addressed
E34 d (ii) a	clearing minimisation procedures (including fencing),	Section 3
E34 d (ii) b	clearing procedures (including nest box plan),	Section 7.5 Attachment F Attachment H
E34 d (ii) c	removal and relocation of fauna during clearing,	Section 9.3
E34 d (ii) d	habitat tree management, and	Section 7.3 Section 7.5
E34 d (ii) e	construction worker education;	Section 4.2
E34 d (ii) f	Installation of exclusion fencing prior to commencement of construction	Section 7.3 Section 7.10 (FF2, FF6 and FF11)
E34 d (iii)	Rehabilitation details, including identification of flora species and sources, and measures for the management and maintenance of rehabilitated areas;	Threatened Flora Species Management Plan Riparian Vegetation Management Map
E34 d (iv)	A Weed Management Strategy, incorporating weed management measures focusing on early identification of invasive weeds and effective management controls (including for those related to aquatic and riparian zones);	Attachment E (Weed Management Strategy) Attachment G (Aquatic Ecology Management Plan)
E34 d (v)	A description of how the effectiveness of these management measures would be monitored;	Section 8 Attachment E (Weed Management Strategy) Attachment G (Aquatic Ecology Management Plan)
E34 d (vi)	A procedure for dealing with unexpected EEC/ threatened species identified during construction, including cessation of work and notification of the OEH, determination of appropriate mitigation measures in consultation with the OEH (including relevant re-location measures) and updating of ecological monitoring and/ or biodiversity offset requirements; and	Section 9.2
E34 d (vii)	Mechanisms for the monitoring, review and amendment of this plan.	Section 8

**Stage 1 Final Compilation of Mitigation Measures**

Table 18: Stage 1 Final Compilation of Mitigation Measures

Stage 1 FCMM Ref	Requirement	Where Addressed
8A	A Flora and Fauna Management Plan will be prepared as part of the CEMP. Native vegetation clearing will not occur until the Flora and Fauna Management Plan is approved. The Flora and Fauna Management Plan will include the following measures as a minimum:	This Plan

## Attachments

Stage 1 FCMM Ref	Requirement	Where Addressed
a)	Site inductions are to include a briefing regarding the local threatened flora and native fauna of the site and protocols to be undertaken if they are encountered	Section 4.2
b)	<p>If any animal is injured, contact the relevant local wildlife rescue agency (e.g. WIRES) and/or veterinary surgery as soon as practical. Until the animal can be cared for by a suitably qualified animal handler, if possible minimise stress to the animal and reduce the risk of further injury by:</p> <ul style="list-style-type: none"> <li>■ Handling fauna with care and as little as possible</li> <li>■ Covering larger animals with a towel or blanket and placing in a large cardboard box</li> <li>■ Placing small animals in a cotton bag, tied at the top</li> <li>■ Keeping the animal in a quiet, warm, ventilated and dark location.</li> </ul>	Section 9.3
c)	Flora and fauna surveys will be undertaken of the RailCorp land prior to commencement of construction in this area. If required, an addendum biodiversity report would be prepared, and the Biodiversity Offset Strategy and the Threatened Species Management Plan would be updated	Section 5.2.1 Section 7.3 RailCorp land south of MPE site: Biodiversity Assessment (Arcadis, December 2016) BAR (Arcadis, 2017)
d)	Clearing of vegetation will be timed to avoid periods when rain is forecast in accordance with Chapter 4.4.2 of 'the Blue Book'	Section 7.5
e)	The extent of vegetation clearing is to be clearly identified on construction plans. Clearly identifying sensitive areas ('no-go areas') which cannot be impacted by construction and managing clearing such that clearing activities are constrained to these approved areas only. High visibility plastic fencing is to be installed to clearly define the limits of the works area within the Rail link specifically the Southern Boot Land, and works areas at the riparian corridor of the Georges River.	Section 7.3 Attachment C: Ecology Sensitive Area and No-Go Maps
f)	In circumstances where native vegetation or mature tree clearing is required outside of the biodiversity study area, an ecologist will inspect the proposed area and provide advice on the impact to flora and fauna and appropriate management.	Section 7.3
g)	Management of noxious weeds is to be undertaken in accordance with the Noxious Weeds Act 1993 and include details relating to the monitoring, management and where necessary eradication of weeds, disposal of green waste, and vehicle/plant weed wash down protocols if required.	Attachment E: Weed Management Strategy
h)	Equipment used for treating weed infestation(s) will be cleaned prior to moving to a new area within the Project site to minimise the likelihood of transferring any plant material and soil.	Attachment E: Weed Management Strategy
i)	Soil stripped and stockpiled from areas containing known weed infestations are to be stored on cleared land at least 40 m from native vegetation.	Attachment E: Weed Management Strategy
j)	Water from the truck wash down in the Rail East Compound will be captured and disposed of offsite to prevent weed spread to adjoining native vegetation.	Attachment E: Weed Management Strategy

## Attachments

Stage 1 FCMM Ref	Requirement	Where Addressed
k)	Works areas at each watercourse crossing will be clearly delineated prior to commencement of works.	Section 7.3
l)	Undertake a two-stage approach to clearing: <ul style="list-style-type: none"> <li>Remove non-hollow bearing trees at least 48 hours before habitat trees are removed</li> <li>Hollow bearing trees are to be knocked with an excavator bucket or other machinery to encourage fauna to evacuate the tree immediately prior to felling</li> <li>Felled trees must be left for a short period of time on the ground to give any fauna trapped in the trees an opportunity to escape before further processing of the trees</li> <li>Felled hollow bearing trees must be inspected by an ecologist as soon as possible (not longer than 2 hours after felling).</li> </ul>	Section 7.5
m)	Fauna microhabitat (such as hollow logs) should be removed from areas to be cleared and relocated to suitable nearby bushland areas in the presence of an ecologist	Section 7.3
n)	Large woody debris will be retained in watercourses where possible. In the event large woody debris are to be impacted they will be relocated in consultation with an ecologist.	Section 7.3
o)	Instream works at Georges River and Anzac Creek will be minimised where possible, including disturbance to aquatic vegetation. Disturbed areas will be contained to the 20 m wide corridor.	Section 7.10
p)	If any pits/trenches are to remain open overnight, they are to be securely covered, where reasonable and feasible. Alternatively, fauna ramps (logs or wooden planks) are to be installed to provide an escape for trapped fauna.	Table 12
q)	Undertake a pre-start up check for sheltering native fauna of all infrastructure, plant and equipment and/or during relocation of stored construction materials	Table 12
r)	Directional lighting will be used where lighting is required in construction areas.	Table 12
8B	Riparian vegetation within the Rail link and adjoining areas of impact at Anzac Creek and the banks of the Georges River would be protected, rehabilitated and managed in accordance with the measures detailed in the Riparian Vegetation Management Plan. Temporarily disturbed riparian areas in the Georges River will be revegetated with locally occurring native species as soon as practicable upon completion of bridge works.	Section 7.10
8C	A nest box management strategy will be prepared prior to clearing of hollow bearing trees. The strategy will inform the installation of nest boxes in retained native vegetation in the riparian corridor of the Georges River and the woodland in the Southern Boot Land and the on-going monitoring and maintenance of nest boxes through the construction and operational phases.	Attachment F: Nest Box Management Strategy
8D	An ecologist will undertake preclearance surveys to confirm the absence of Grey-headed Flying-fox roosting camps within the Rail link, no more than 48 hours prior to the clearance of vegetation. The DotEE will be notified in writing of the results of preclearance surveys. If the species is detected roosting on site, no native vegetation clearance will commence until any directions of the Minister have been complied with.	Section 7.3

## Attachments

Stage 1 FCMM Ref	Requirement	Where Addressed
8E	Works within the Southern Boot Land, or in other areas, with the potential to impact on <i>Persoonia nutans</i> and <i>Grevillea parviflora</i> subsp. <i>parviflora</i> will be undertaken in accordance with the Threatened Flora Species Management Plan.	Section 7.10 As applicable to the CPB construction boundary
8F	Water quality and macroinvertebrate monitoring would be undertaken up and downstream of works within the Georges River and Anzac Creek, pre, during and post construction, to determine impacts on aquatic communities as a result of the Project. The monitoring plan would be developed and implemented by an appropriately qualified aquatic ecologist.	Section 8.1 Attachment G: Aquatic Ecology Monitoring Plan
8G	A visual inspection of the Georges River for dead or distressed fish (indicated by fish gasping at the water surface, or fish crowding at the creek's banks) is to be undertaken daily during the construction of the Georges River bridge. Observations of dead or distressed fish are to be immediately reported to DPI (Fisheries). In the event dead or distressed fish are found, all works are to cease until the issue is rectified and approval from DPI Fisheries is given to proceed.	Table 12 Section 8.1 Section 0 PSP – Georges River Bridge
8H	The corridor established for construction of the Rail link will be stabilised in a manner which would enable the fuel load to be maintained in a low state. Where appropriate it would be stabilised following construction with local topsoil with growth of groundcover encouraged. The corridor would be managed by removing weeds and reducing the fuel load.	Section 7.6 Bushfire Management Strategy

## NSW Concept Plan Conditions of Approval

Table 19: NSW Concept Plan Approval Conditions

NSW Concept Plan CoA Ref	Requirement	Where Addressed
2.10	Any future Development Application shall include a Flora and Fauna assessment. The assessment shall:	Stage 1 EIS
a)	Assess impacts on the biodiversity values of the site and adjoining areas, including Endangered Ecological Communities and threatened flora and fauna species and their habitat, impacts on wildlife and habitat corridors, riparian land, and habitat fragmentation and details of mitigation measures, having regard to the range of fauna species and opportunities for connectivity (terrestrial, arboreal and aquatic) across the rail link between the site and the EHPL.	Stage 1 EIS
b)	Include a Vegetation Management Plan that has been prepared in consultation with the NSW Office of Water.	Riparian Vegetation Management Plan (Response to Submissions – Appendix J – Biodiversity Assessment Report)
c)	Document how impacts to the <i>Persoonia nutans</i> and the <i>Grevillea parviflora</i> subsp. <i>Parviflora</i> flora species have been minimised through the detailed design process.	Stage 1 EIS
d)	Include the details of available offset measures to compensate the biodiversity impacts of the Project where offset measures are proposed to address residual impacts, in particular the following should be considered:	Biodiversity offsets are outside of CPB's scope



## Attachments

NSW Concept Plan CoA Ref	Requirement	Where Addressed
	<ul style="list-style-type: none"> <li>As stipulated in principle 2 of 'NSW offset principles for major projects (state significant development and infrastructure)', for terrestrial biodiversity, established assessment tools, such as the BioBanking Assessment Methodology (BBAM), are considered best practice</li> <li>The Biodiversity Offset Strategy will be undertaken in accordance with the 'NSW offset principles for major projects (state significant development and state significant infrastructure)'</li> <li>Offsets shall be identified, and demonstrate that they can be secured.</li> </ul>	

## NSW Concept Plan Revised Statement of Commitments

Table 20: NSW Concept Plan Revised Statement of Commitments

NSW Concept Plan Revised SoC Ref	Requirement	Where Addressed
	The Proponent will undertake further detailed assessment to establish the potential biodiversity impacts of the proposed rail link and measures to mitigate its potential impacts. The investigations shall incorporate the mitigation measures listed within Section 5 of the Flora and Fauna Assessment and as summarised below:	Stage 1 EIS
1.51	<u>Avoid Impacts</u>	
a)	Site establishment, earthworks and rail construction.	Stage 1 EIS
1.52	<u>Mitigate Impacts</u>	
b)	Soil disturbance related to site establishment, earthworks and rail construction.	Stage 1 EIS
c)	Vegetation clearance for rail construction, access and maintenance tracks.	Stage 1 EIS
d)	Construction in riparian areas/in proximity to watercourse.	Stage 1 EIS
e)	Construction of pavement, slabs and building structures.	Stage 1 EIS
f)	Hot works (including vegetation clearing requiring heat producing equipment).	Stage 1 EIS
g)	Alteration to air quality and noise environments.	Stage 1 EIS
h)	Operation of the SIMTA Project.	OEMP
1.53	<u>Management of Threatened Plant Species</u>	
	The Proponent shall prepare and implement a Threatened Species Management Plan for the <i>Persoonia nutans</i> and <i>Grevillea parviflora</i> subsp. <i>parviflora</i> populations within the rail corridor that would be affected by the rail link.	Threatened Flora Species Management Plan (Response to Submissions – Appendix J – Biodiversity Assessment Report)
1.54	<u>Off-Set Impacts</u>	

## Attachments

NSW Concept Plan Revised SoC Ref	Requirement	Where Addressed
	The Proponent will update the Preliminary Biodiversity Offset Strategy (Hyder Consulting 2013) in accordance with the NSW offset principles for major projects (state significant development and state significant infrastructure) and continue to consult with the Department of the Environment and Energy (DotEE) through the project approval processes. The offset package will be secured before any clearing of endangered ecological communities or threatened species is carried out.	Biodiversity offsets are outside of CPB's scope
<b>1.55</b>	<u>Aquatic Flora and Fauna</u>	
	The Proponent will implement the following measures to protect the aquatic flora and fauna as part of the applications for the detailed planning applications (where relevant and applicable):	Stage 1 EIS
a)	Implementation of design principles for friendly fish passage.	Design Report
b)	Implementation of Construction and Operation Management Plans for maintenance of structures in riparian and aquatic zones.	CEMP This Plan
c)	Minimise siltation of the Georges River during construction through implementing the water quality mitigation measures detailed within the Stormwater and Flooding section of the Statement of Commitments.	CSWMP
d)	Thorough assessment of any development within Anzac Creek CSWL community, including potential impacts on groundwater quality and quantity.	Stage 1 EIS
e)	Lantana removal within nominated construction zones to reduce degradation of streamside vegetation and offset any potential impacts to aquatic biodiversity.	Attachment E: Weed Management Strategy
<b>1.56</b>	<u>Riparian</u>	
a)	The proposed rail link (located within the rail corridor) is exempt from the requirement for a WM Act controlled activity approval from NOW as a transitional Part 3A project; however the detailed design of the rail link will seek to conform to the objects of the WM Act and its associated guidelines.	Design Report
b)	The riparian setback for Anzac Creek, as specified by NOW, is 30 meters (20 metre CRZ and 10 metre VB), while for Georges River the riparian setback is likely to be a minimum of 50 Meters (40 metre CRZ and 10 metre VB).	Riparian Vegetation Management Plan (Response to Submissions – Appendix J – Biodiversity Assessment Report)
c)	Riparian corridors will be appropriately revegetated to restore and/or maintain ecological, functional and habitat values and impede surface flows and drop sediment before it reaches the waterways.	Riparian Vegetation Management Plan (Response to Submissions – Appendix J – Biodiversity Assessment Report)

## Attachments

NSW Concept Plan Revised SoC Ref	Requirement	Where Addressed
d)	Water quality and quantity issues will be managed during the construction phase through the implementation, inspection and maintenance of best practice soil and water management techniques which will be defined in the CEMP for sedimentation and erosion control during construction.	CSWMP
e)	Water quality and quantity issues will be managed during the operation phase through the implementation, inspection and maintenance of Water Sensitive Urban Design (WSUD) measures such as rainwater tanks, grass filter strips, swales and bio retention.	N/A – Operational requirement

## Commonwealth Conditions of Approval

Table 21: Commonwealth Conditions of Approval

Commonwealth CoA Ref	Requirement	Where Addressed
1	For the better protection of the Grey-headed Flying-fox (GHFF), the person take the action must:	EIS Section14
a)	Not clear more than 11 hectares of GHFF foraging habitat;	Section 7.3
b)	Engage a suitably qualified expert to undertake a preclearance survey(s) to confirm the absence of GHFF roosting camps within the rail easement, no more than 48 hours prior to the clearance of potential GHFF roosting habitat; and	Section 7.3
c)	Notify the Department in writing of the results of preclearance surveys	Section 8.2
	If the GHFF is detected roosting on site, all native vegetation clearance activities must halt until the person taking the action has complied with any directions the Minister may wish to issue regarding timing of construction or methods for dispersal of the GHFF.	Section 7.3
2	For the better protection of the Macquarie Perch, the person taking the action must:	
a)	Engage a suitably qualified expert to design (or provide input on the design of) all crossings which are proposed to be implemented across Macquarie Perch habitat. Any such crossings must be of a suitable design that provides for the passage requirements of Macquarie Perch; and	Design Report
b)	Implement all feasible and practicable measures that ensure sedimentation and / or erosion (as a result of the proposed action) do not lead to any further reductions in the water quality, or degradation of, Macquarie Perch habitat.	CSWMP This Plan
3	For the better protection of <i>Hibbertia sp. Bankstown</i> , the person taking the action must engage a suitably qualified expert to undertake a targeted search for individuals of <i>Hibbertia sp. Bankstown</i> within all areas of potential habitat during the species' flowering period.	Stage 1 EIS

## Attachments

Commonwealth CoA Ref	Requirement	Where Addressed
4	For the better protection of Bynoe's Wattle, the person taking the action must engage a suitably qualified expert to undertake a field habitat assessment that targets the ecological requirements of Bynoe's Wattle, in all areas of Castlereagh Scribbly Gum Woodland likely to be cleared as a result of the proposed action. If the assessment determines there is potential for the species to occur on site, then a suitably qualified expert must undertake a targeted search for individuals of Bynoe's Wattle within all areas of potential habitat identified by the habitat assessment during the species' flowering period.	Stage 1 EIS
5	For the better protection of EPBC listed flora and the environment on Commonwealth land, the person taking the action must engage a suitably qualified expert to prepare a Flora and Fauna Management Plan (FFMP) for the approval of the Minister. The FFMP must include (but need not be limited to):	This Plan
5a	Details on the timing of native vegetation clearance works;	CEMP – Section 1.3 CFFMP – Section 1.3
5b	Detailed maps of the rail link easement and construction zone showing: <ul style="list-style-type: none"> <li>■ Permanent infrastructure and temporary works</li> <li>■ No-go areas</li> <li>■ Physical barriers used for the protection of native vegetation on Commonwealth land, and of EPBC Act listed Nodding Geebung and Small-flower Grevillea.</li> </ul>	Attachment C: Ecology Sensitive Area and No-Go Maps Section 7.3 and 7.4
5c	Measures to minimise the extent of native vegetation clearing upon Commonwealth land and the clearing of Nodding Geebung and Small-flower Grevillea.	Section 7.1 Section 7.3 Section 7.4 Section 7.5 Section 7.10 (Table 12)
5d	Provisions to ensure no more than 17 individuals of Nodding Geebung and 634 stems of Small-flower Grevillea are cleared.	Section 7.1 Section 7.3 Section 4
5e	The results of targeted surveys for <i>Hibbertia sp. Bankstown</i> and Bynoe's Wattle (including the number of individuals recorded) and what measures will be implemented to avoid, mitigate and manage impacts to these species, if individuals are found on site.	Stage 1 EIS Section 5.2.1 Section 5.3 Section 7.3 Section 7.4 Section 9.2
5f	Measures which allow terrestrial fauna to disperse naturally ahead of clearing activities, and minimise the risk of injury to individuals.	Section 7.5 Section 7.9
5g	Actions to maintain or enhance the long-term viability of native vegetation adjoining the rail easement in particular, adjoining populations of <i>Nodding Geebung</i> and <i>Small-flower Grevillea</i> .	Section 7.10 Appendix C Threatened Flora Species Management Plan (Response to

## Attachments

Commonwealth CoA Ref	Requirement	Where Addressed
		Submissions – Appendix J – Biodiversity Assessment Report)
5h	Measures to safeguard flora and fauna from the threat of weeds, fire, pathogens and unauthorised access, including (but not limited to) the commitments outlined in section 7.4.1 of the <i>EIS</i> (and summarised at Annexure A).	Section 6.1 & 7.10 Threatened Flora Species Management Plan (Response to Submissions – Appendix J – Biodiversity Assessment Report)
5i	Ongoing monitoring to inform the adaptive management of native vegetation adjoining the rail easement.	Section 8.4

## Commonwealth Concept Plan Mitigation Measures

Table 22: Commonwealth Concept Plan Mitigation Measures

C'th Concept Plan MM Ref	Requirement	Where Addressed
7.4.1.1	The Part 3A Guidelines for Threatened Species Assessment (DEC and DPI 2005) require the description and justification of measures to mitigate adverse effects arising from development Projects. Primary consideration should be given to measures to avoid or minimise impacts; where avoidance and mitigation are not possible, offset strategies may be considered as a last resort. The steps in the avoid, mitigate and offset approach are as follows:	This Plan Stage 1 EIS Biodiversity Offset Strategy
a)	Avoid areas of high biodiversity value wherever possible.	Stage 1 EIS
b)	Mitigate actions and safeguard values identified for retention by prescribing appropriate controls.	Stage 1 EIS
c)	Compensate for or offset the removal of biodiversity values.	Biodiversity are offsets outside of CPB scope
7.4.1.2	<u>Avoid</u>	
a)	The identified ecological values should be avoided as far as practicable	Stage 1 EIS
b)	The construction footprint of the SIMTA Project and construction access requirements should be reduced as far as possible to minimise impacts.	Stage 1 EIS
c)	Avoid Endangered Ecological communities where possible.	Stage 1 EIS
d)	Avoid known locations of threatened flora species where possible.	Stage 1 EIS
e)	Avoid important fauna habitat features such as large hollow bearing trees where possible.	Stage 1 EIS
7.4.1.3	<u>Mitigate</u>	
a)	Install appropriate drainage infrastructure (e.g. sediment basins, diversion drains), sediment and erosion controls prior to the commencement of construction.	CEMP

## Attachments

C'th Concept Plan MM Ref	Requirement	Where Addressed
b)	Clearing of vegetation is not to be undertaken during overland flow events.	Section 7.5
c)	Clearly identifying sensitive areas and areas for construction and managing clearing such that clearing activities are constrained to these approved areas only.	Attachment C: Ecology Sensitive Area and No-Go Maps
d)	Locate soil or mulch stockpiles away from watercourses and key stormwater flow paths to limit potential transport of these substances into the watercourses via runoff.	CEMP
e)	Dust suppression activities to be undertaken where appropriate.	CEMP
f)	Stabilisation of disturbed areas, including revegetation in accordance with the VMP, is to be undertaken as soon as practicable after disturbance.	CEMP Attachment E: Weed Management Strategy
g)	Emergency response protocols and procedures for implementation in the event of a contaminant spill or leak to be clearly articulated in the Construction Environmental Management Plan.	CEMP
h)	Spill kits to be located to allow for timely response to uncontained spills. Site inductions are to include a briefing on the use of spill kits.	CEMP
i)	Management of weeds in and adjacent to cleared areas will occur in accordance with a Weed Management Plan. This plan will include details relating to the monitoring, management and where necessary eradication of weeds, disposal of green waste, and vehicle/plant weed wash down protocols if required.	Attachment E: Weed Management Strategy Biodiversity Offset Strategy
j)	Management of noxious weeds are to be undertaken in accordance with the <i>Noxious Weeds Act 1993</i> .	Attachment E: Weed Management Strategy
k)	Equipment used for treating weed infestation will be cleaned prior to moving to a new area within the project site to minimise the likelihood of transferring any plant material and soil.	Attachment E: Weed Management Strategy
l)	Soil stripped and stockpiled from areas containing known weed infestations are to be stored separately and are not to be moved to areas free of weeds.	Attachment E: Weed Management Strategy
m)	Fauna microhabitat such as logs should be removed from areas to be cleared and relocated to suitable nearby bushland areas in the presence of an ecologist.	Section 7.3
n)	Consider the installation of nest boxes in woodland vegetation in the rail corridor that may offer alternative nesting habitat to hollow dependent species recorded in the study area.	Attachment F: Nest Box Management Strategy
o)	High visibility plastic fencing is to be installed to clearly define the limits of the works area to not further encroach on fauna habitat.	Section 7.3
p)	Undertake a pre-start up check for sheltering native fauna of all infrastructure, plant and equipment and/or during relocation of stored construction materials.	Table 12
q)	Undertake a two-stage approach to clearing:	Section 7.5

## Attachments

C'th Concept Plan MM Ref	Requirement	Where Addressed
	<ul style="list-style-type: none"> <li>Remove non-hollow bearing trees at least 48 hours before habitat trees are removed.</li> <li>Hollow bearing trees are to be knocked with an excavator bucket or other machinery to encourage fauna to evacuate the tree immediately prior to felling.</li> <li>Felled trees must be left for a short period of time on the ground to give any fauna trapped in the trees an opportunity to escape before further processing of the trees.</li> <li>Felled hollow bearing trees must be inspected by an ecologist as soon as possible (not longer than 2 hours after felling).</li> </ul>	
r)	Site inductions are to include a briefing regarding the local fauna of the site and identification of protocols to be undertaken if fauna are encountered.	Section 4.2
s)	If any pits/trenches are to remain open overnight, they are to be securely covered, if possible. Alternatively, fauna ramps (logs or wooden planks) are to be installed to provide an escape for trapped fauna.	Table 12
t)	Clearance of native vegetation should be minimised as far as is practicable.	Stage 1 EIS
u)	Consider retention of some, or all, of the remnant scattered <i>E. sclerophylla</i> over patches of shrub and grass cover in the cleared grassland immediately south of the SIMTA site, in landscaping works.	Stage 1 EIS
v)	The extent of, and limitations to, vegetation clearing would be clearly identified on construction plans.	Attachment C: Ecology Sensitive Area and No-Go Maps
w)	Any additional construction areas, such as site offices, construction stockpile locations and machinery/equipment laydown areas are to be located, where possible, within existing cleared or disturbed areas.	Stage 1 EIS
x)	Extent of clearing should be fenced with highly visible temporary fencing to minimise any extension of clearing beyond the area necessary.	Section 7.3
y)	A VMP should be prepared prior to construction, detailing restoration, regeneration and rehabilitation of areas of native vegetation in study area. The VMP should also detail appropriate management for the potential habitat of threatened plant species in the study area, including monitoring during and after construction works to ensure impacts are minimised.	Riparian Vegetation Management Plan (Response to Submissions – Appendix J – Biodiversity Assessment Report) Attachment E: Weed Management Strategy
z)	As soon as possible rehabilitation will commence where possible. Management of land disturbed as a result of construction works will occur in accordance with a VMP.	Section 7.10 Threatened Flora Species Management Plan (Response to Submissions – Appendix J – Biodiversity Assessment Report)



## Attachments

C'th Concept Plan MM Ref	Requirement	Where Addressed
		Attachment E: Weed Management Strategy
aa)	High visibility plastic fencing is to be installed to clearly define the limits of the works area as to not further encroach on EEC and locations of threatened flora species.	Section 7.3
ab)	Fencing is to be installed delineating threatened species habitat to be retained. Appropriate warning signage is to be installed along this fencing at regular intervals. Site inductions are to include a briefing on the presence of threatened species and its habitat, its significance and locations and extents of no-go zones.	Section 7.10 Threatened Flora Species Management Plan (Response to Submissions – Appendix J – Biodiversity Assessment Report)
ac)	Design and construction of rail crossings over Anzac Creek and Georges River to be in accordance with Fish Passage Requirements for Waterway Crossings (Fairfull and Witheridge 2003).	Design Report Table 12
ad)	Minimise clearing and disturbance to the riparian zone where possible.	Stage 1 EIS
ae)	Install appropriate drainage infrastructure (e.g. sediment basins, diversion drains), sediment and erosion controls prior to the commencement of construction.	CEMP
af)	Construction disturbance areas will be clearly demarcated to avoid accidental clearing or stockpiling in riparian vegetation.	Section 7.3
ag)	Landscaped zones to capture gross pollutants and oil and grits from pavement. These areas can be regularly maintained to remove rubbish and can be renewed on a regular basis.	Table 12
ah)	Bio-retention installed in base of channels and swales proposed to capture and store stormwater. This will consist of bio-filtration layers, planting and subsoil collection and drainage.	Table 12
ai)	Hot work not to be undertaken on declared total fire ban days.	Bushfire Management Strategy
aj)	Vehicles and plant should not block fire trails.	Bushfire Management Strategy
ak)	Bushfire awareness included in staff induction and in toolbox talks pre-commencement.	Bushfire Management Strategy
al)	Directional lighting will be used where lighting is required in construction areas.	Table 12
am)	Frequent maintenance of construction machinery and plant will be undertaken to minimise unnecessary noise.	CAQMP
an)	Dust suppression activities to be undertaken where appropriate.	CAQMP

**Attachments**

C'th Concept Plan MM Ref	Requirement	Where Addressed
ao)	Speed limits will be developed so as to minimise the potential for fauna to be struck by a vehicle within the SIMTA site. All vehicles and plant in operation on the SIMTA site are to adhere to site rules relating to speed limits.	CEMP
ap)	If an animal is injured, contact one of the following local wildlife rescue agency (e.g. WIRES) and/or veterinary surgery immediately	Section 9.3
aq)	Until the animal can be cared for by a suitably qualified animal handler, if possible minimise stress to the animal and reduce the risk of further injury by: Handling fauna with care and as little as possible. Covering larger animals with a towel or blanket and placing in a large cardboard box. Placing small animals in a cotton bag, tied at the top. Keeping the animal in a quiet, warm, ventilated and dark	Section 9.3
as)	Weed infestations that are identified during the operation of the SIMTA Project are to be managed in accordance with the removal methods outlined in the Weed Management Plan.	Attachment E: Weed Management Strategy

## Attachment B: Glossary

The following table outlines key terms used in this document and associated procedures:

Term	Definition
ANZECC	Australian and New Zealand Environment Conservation Council
APVMA	Australian Pesticides and Veterinary Medicines Authority
ARI	Average Recurrence Interval
ARTC	Australian Rail Track Corporation
AUSRIVAS	Australian River Assessment System
BAR	Biodiversity Assessment Report
CBD	Central Business District
CAP	Construction Area Plan – The main document prepared during the construction planning for that work area. Includes construction methodology, risk assessment, constructability reviews and Work Pack listing.
CCC	Campbelltown City Council
CEMP	Construction Environmental Management Plan
CLWD	Crown Lands Water Division (Previously NSW Water / DPI Water)
CFFMP	Construction Flora and Fauna Management Plan
CoA	Condition of Approval
DA	Development Application
DoD	Department of Defence (Commonwealth)
DotEE	Department of the Environment and Energy (Commonwealth)
DPI	Department of Primary Industries
DP&E	Department of Planning and Environment
DPI (Fisheries)	Department of Primary Industries, Fishing and Aquaculture
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EMS	Environmental Management System
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPA	Environment Protection Authority
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
EPBC Approval	Approval (No. 2011/6229) granted under the EPBC Act on March 2014 by the Commonwealth Department of the Environment and Energy for the development of the SIMTA IMT Facility at Moorebank.
EPL	Environment Protection Licence

## Attachments

Term	Definition
FM Act	NSW <i>Fisheries Management Act 1994</i>
Former DNSDC South	The land to the south of the operational footprint of the Stage 1 site, to the boundary fence of the former DNSDC
GDE	Groundwater Dependent Ecosystems
IMEX	Import / Export
Impact Area / Area of Impact	Rail corridor construction footprint plus 100m buffer
LCC	Liverpool City Council
LEP	Local Environmental Plan
LGA	Local Government Area
MIC	Moorebank Intermodal Company
MIC Project	Moorebank Intermodal Terminal Project (SSD-5066) approved under Part 4, Division 4.1 of the <i>Environmental Planning and Assessment Act 1979</i>
MNES	Matters of National Environmental Significance
NOW	NSW Office of Water
NSW	New South Wales
NW Act	<i>Noxious Weeds Act 1993</i>
OEH	NSW Office of Environment and Heritage
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
Previous Rail Link	The Rail link alignment provided within the Stage 1 EIS dated May 2015
RailCorp Land	Lot 1 DP 825352 (part of the Rail Corridor) and owned by RailCorp
RALP No. 1	Rail Access Land Package No. 1 (this Project)
RVMP	Riparian Vegetation Management Plan (Response to Submissions – Appendix J – Biodiversity Assessment Report)
SEH	Significant Environmental Hazard – For the purposes of this CEMP an Environmental Hazard is taken to be the same as an Environmental Aspect (ISO 14001:2004). It is an element of the project's activities or products or services that can interact with the environment. Significant environmental hazards are those environmental hazards that have the potential to have a significant adverse impact on the environment and that require persistent and multiple levels of controls.
SIMTA	Sydney Intermodal Terminal Alliance – a consortium comprising Qube Holdings and Aurizon
SME	School of Military Engineering
Southern Boot Land	Southern Boot Land includes Commonwealth owned land (Lot 4, DP 1197707) to the south of the former DNSDC south, and to the north of the EHPL (part of the Boot Land as described in the MIC proposal).
SSD	State Significant Development

**Attachments**

Term	Definition
SSFL	Southern Sydney Freight Line
TEC	Threatened Ecological Community
TEU	Twenty-foot Equivalent Unit
TFSMP	Threatened Flora Species Management Plan (Response to Submissions – Appendix J – Biodiversity Assessment Report)
TSC Act	<i>Threatened Species Conservation Act 1995</i>
Work Area	A separable portion of work that is identified early in construction planning to help drive early definition of construction methodology and alignment of design activities. Work Areas should be listed in the overall construction methodology. The planning document for a work area is called a Construction Area Plan.
Work Pack	A pack of relevant construction documents that contains relevant information for Site Engineers and foremen to manage the works. There will be multiple Work Packs contained in a CAP. A Work Pack contains work method statements, risk assessments, ITPs, drawings, site instructions, environmental controls, etc.
Work Procedure	A document that provides a detailed step-by-step description for how work activities will be carried out. May document Risks & Controls associated with each step.

## Attachments

### **Attachment C: Ecology Sensitive Area and No-Go Maps**

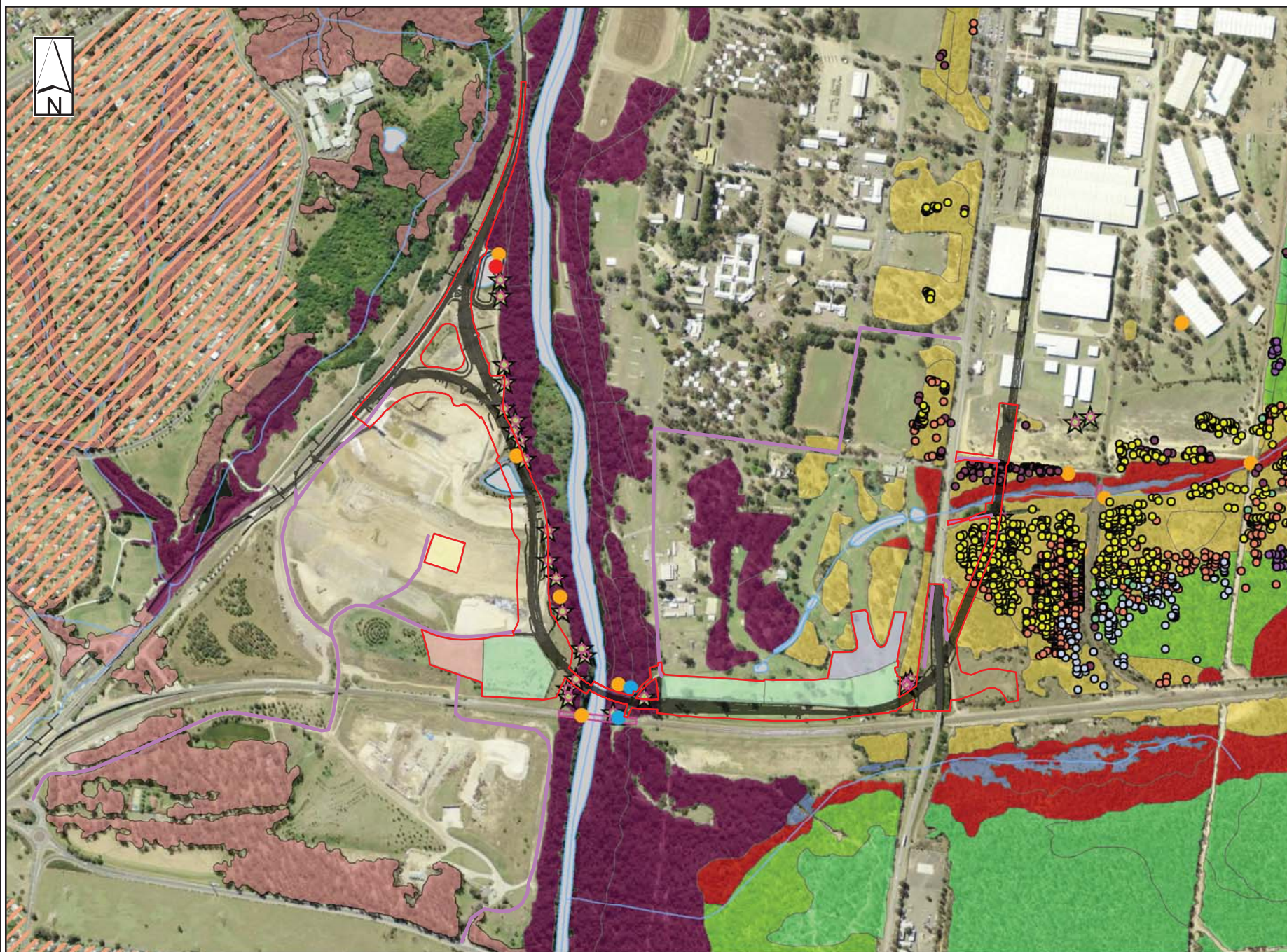
*Refer to the Project BAR (Arcadis 2017) for biodiversity mapping.*





## LEGEND

- Rail Link
- Project Access Roads
- Construction Boundary
- Water Course
- RALP Compounds
- GWS Temporary Stockpile
- RAE Stockpile Site
- Crushing stockpile site
- Sensitive Receivers
- Threatend Flora & Fauna**
  - Acacia bynoeana
  - Acacia pubescens
  - Grevillea parviflora subsp. parviflora
  - Hibbertia fumana
  - Hibbertia puberula subsp. puberula
  - Persoonia nutans
  - Myotis macropus
  - Mormopterus norfolkensis
  - Miniopertus schreibersii oceanensis
  - Southern Myotis
  - ★ Hollow Bearing Trees
- Vegetation Community**
  - Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion
  - Castlereagh Swamp Woodland Community
  - Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion
  - Cumberland Plain Woodland in the Sydney Basin Bioregion
  - Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
  - River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
  - Shale Gravel Transition Forest in the Sydney Basin Bioregion



340 170 0 340

Metres

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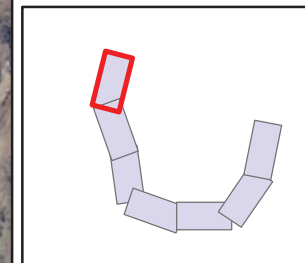
## SIMTA Moorebank Intermodal Terminal Stage 1 - Rail Link

### Project Wide Sensitive Area Map



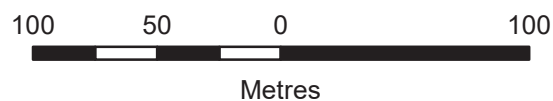


## EXTENT



## Legend

- No-Go Fencing
- Rail Link
- Preferred Construction Boundary
- No-Go Areas
- Crushing stockpile site
- GWS Temporary Stockpile
- RAE Stockpile Site
- RALP Compounds

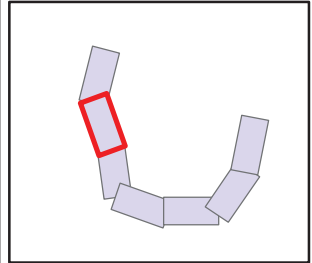


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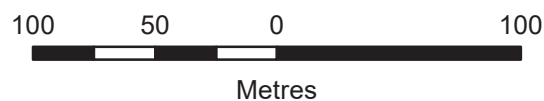


EXTENT



Legend

-  No-Go Fencing
-  Rail Link
-  Preferred Construction Boundary
-  No-Go Areas
-  Crushing stockpile site
-  GWS Temporary Stockpile
-  RAE Stockpile Site
-  RALP Compounds

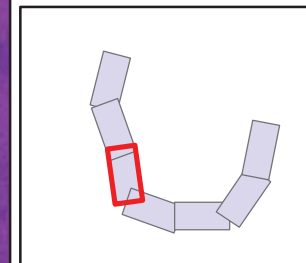


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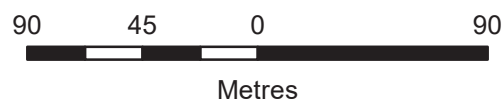
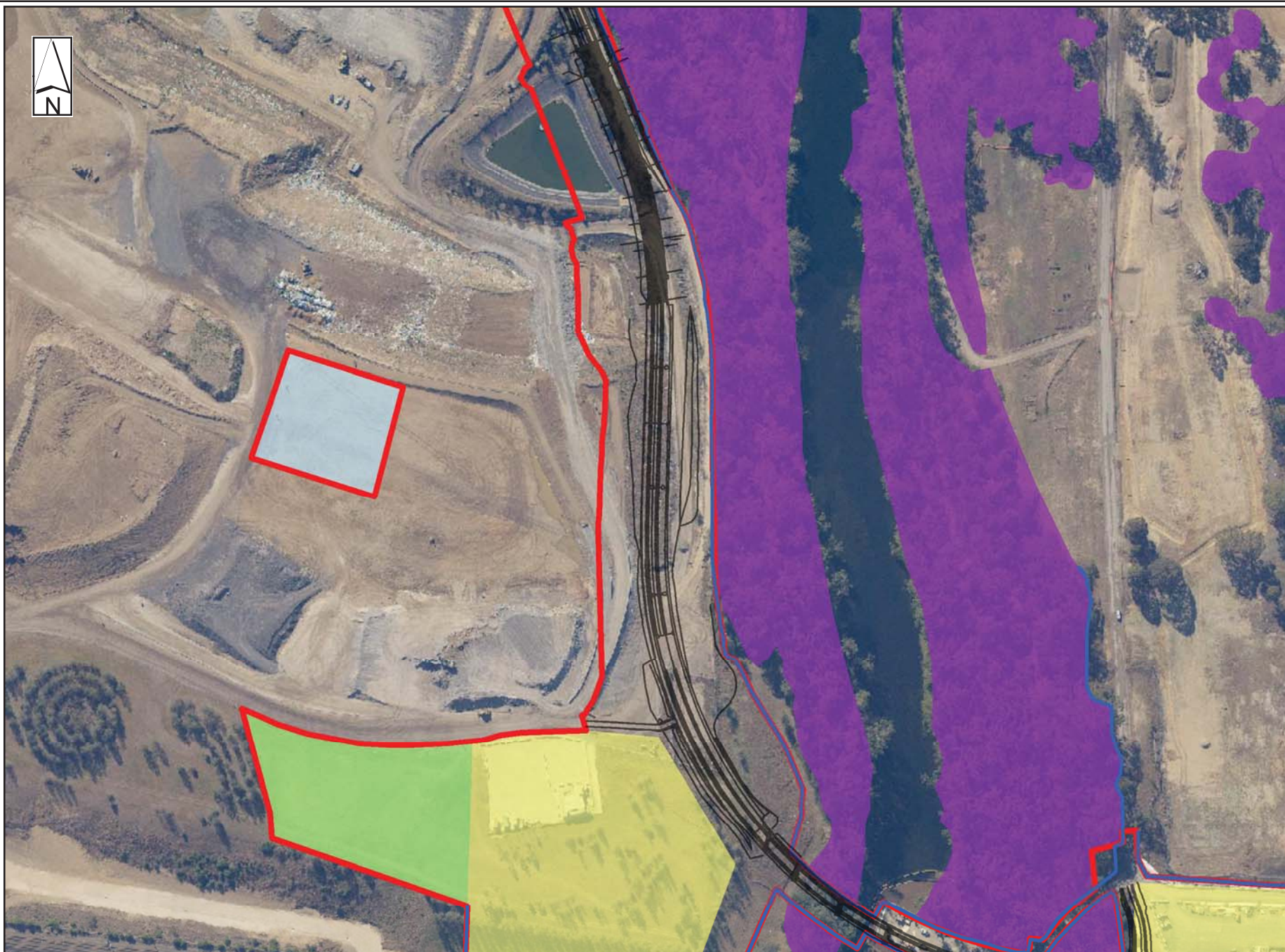


## EXTENT



## Legend

- No-Go Fencing
- Rail Link
- Preferred Construction Boundary
- No-Go Areas
- Crushing stockpile site
- GWS Temporary Stockpile
- RAE Stockpile Site
- RALP Compounds

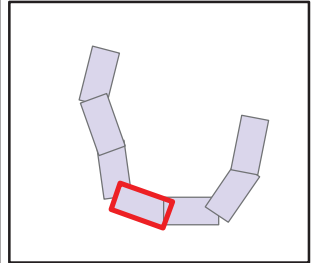


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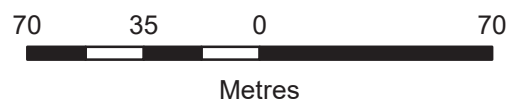
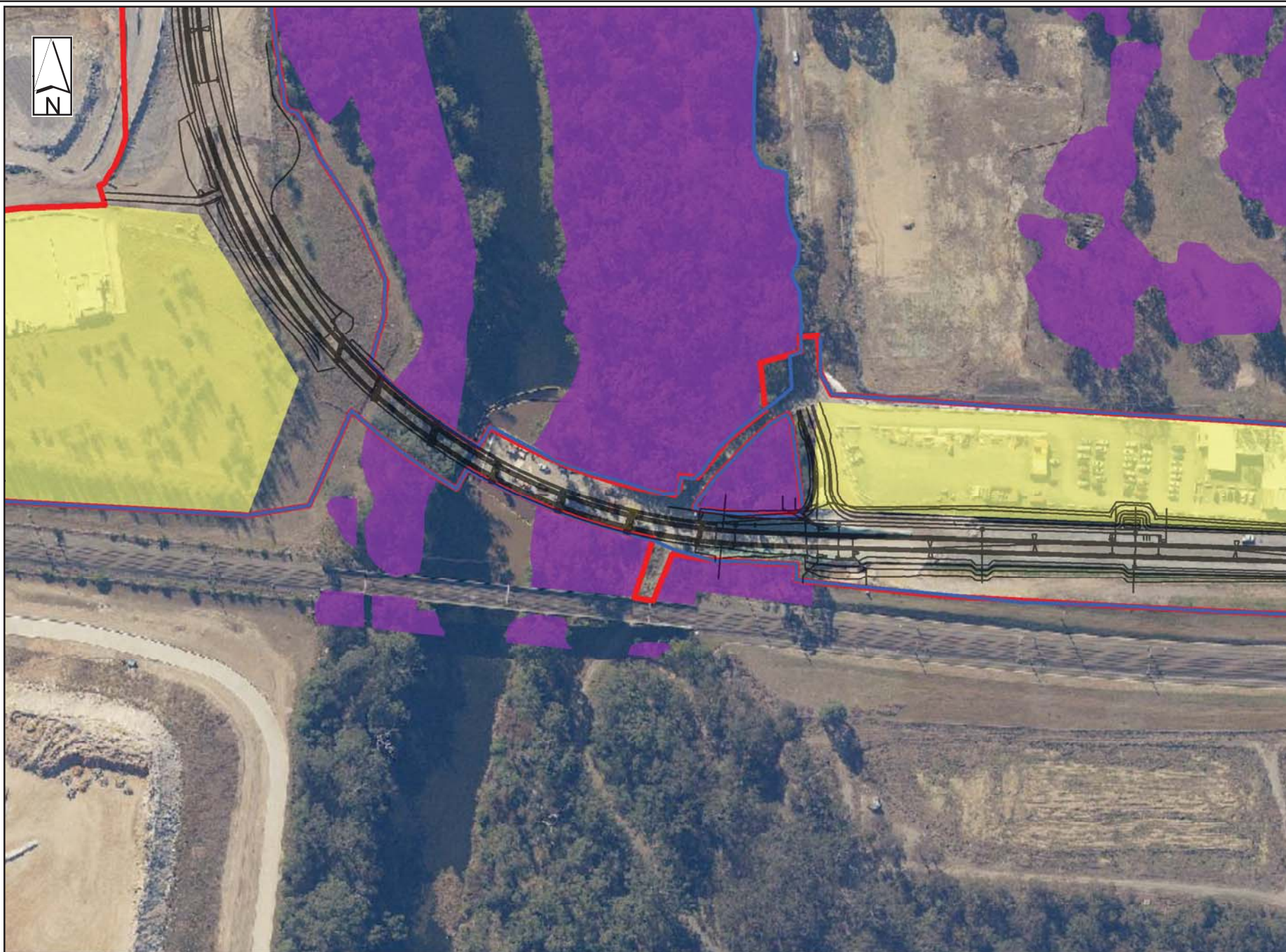


## EXTENT



## Legend

- No-Go Fencing
- Rail Link
- Preferred Construction Boundary
- No-Go Areas
- Crushing stockpile site
- GWS Temporary Stockpile
- RAE Stockpile Site
- RALP Compounds

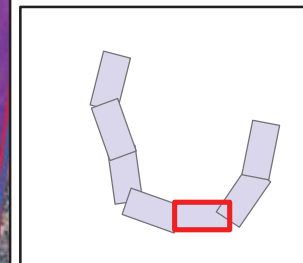


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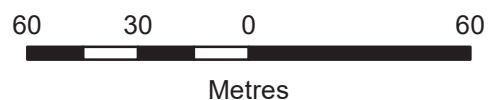


## EXTENT



## Legend

- No-Go Fencing
- Rail Link
- Preferred Construction Boundary
- No-Go Areas
- Crushing stockpile site
- GWS Temporary Stockpile
- RAE Stockpile Site
- RALP Compounds

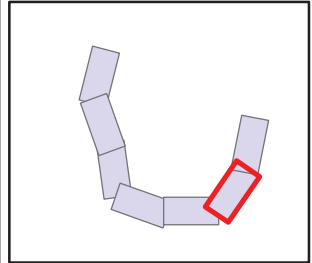


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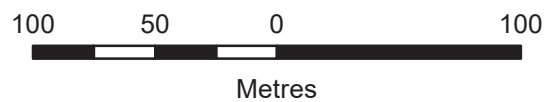
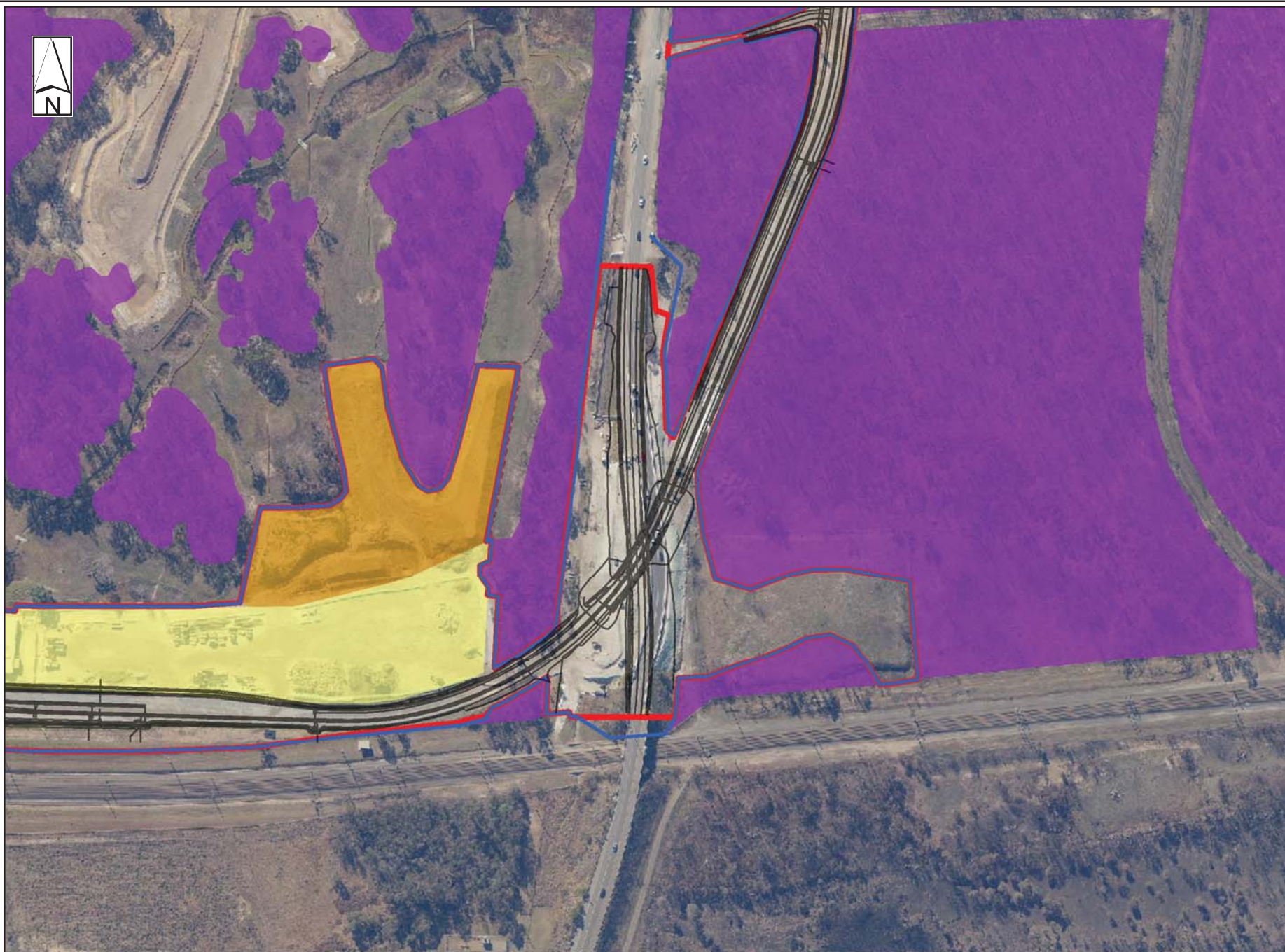


## EXTENT



## Legend

- No-Go Fencing
- Rail Link
- Preferred Construction Boundary
- No-Go Areas
- Crushing stockpile site
- GWS Temporary Stockpile
- RAE Stockpile Site
- RALP Compounds

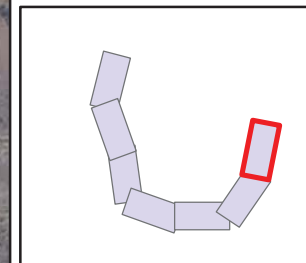


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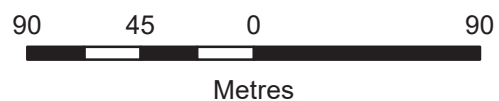


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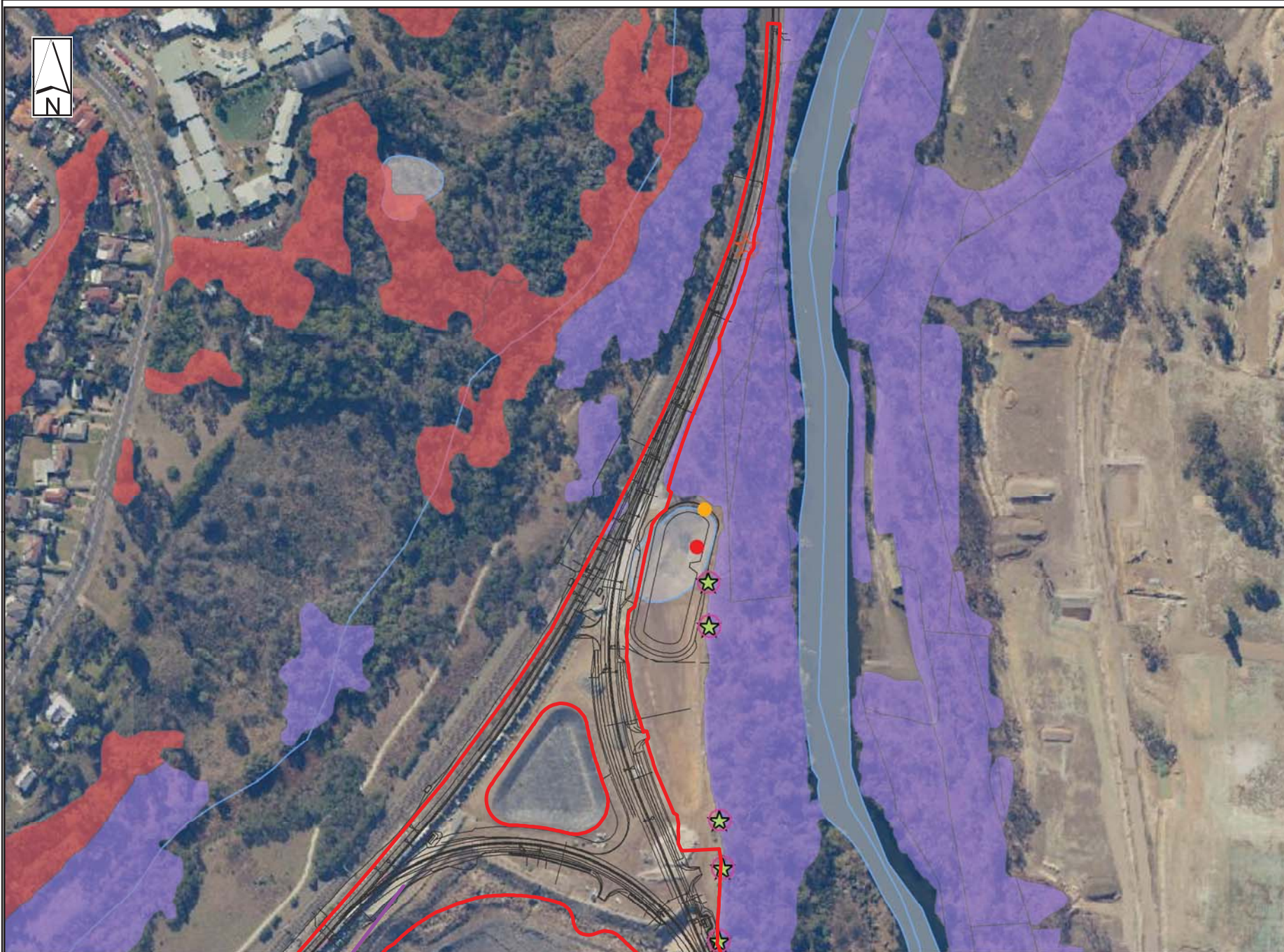
## Legend

- No-Go Fencing
- Rail Link
- Preferred Construction Boundary
- No-Go Areas
- Crushing stockpile site
- GWS Temporary Stockpile
- RAE Stockpile Site
- RALP Compounds



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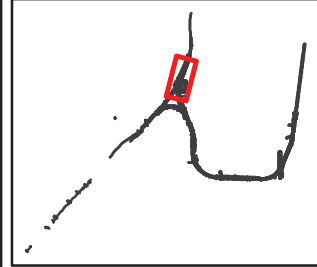
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## SIMTA Moorebank Intermodal Terminal Stage 1 - Rail Link Ecology Constraints Sensitive Area Map

EXTENT

CPB  
CONTRACTORS



### LEGEND

- Surface Water Monitoring
  - Construction Boundary
  - MA14 Salvage Footprint
  - Project Access Roads
  - RAE Stockpile Site
  - Crushing stockpile site
  - GWS Temporary Stockpile
  - Ancillary Facilities
- #### Threatened Flora & Fauna
- Acacia bynoeana
  - Acacia pubescens
  - Grevillea parviflora subsp. parviflora
  - Hibbertia fumana
  - Hibbertia puberula subsp. puberula
  - Persoonia nutans
  - Myotis macropus
  - Mormopterus norfolkensis
  - Miniopterus schreibersii oceanensis
  - Pteropus poliocephalus
  - Southern Myotis
  - Hollow Bearing Trees (EIS)
  - Hollow Bearing Trees (Pre Clearance Surveys)
- Rail Link
- #### Vegetation Community
- Castlereagh Scribbly Gum
  - Woodland in the Sydney Basin Bioregion
  - Castlereagh Swamp Woodland Community
  - Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion
  - Cumberland Plain Woodland in the Sydney Basin Bioregion
  - Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
  - River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
  - Shale Gravel Transition Forest in the Sydney Basin Bioregion
  - Water Course





## EXTENT



## LEGEND

- Surface Water Monitoring
- Construction Boundary
- MA14 Salvage Footprint
- Project Access Roads
- RAE Stockpile Site
- Crushing stockpile site
- GWS Temporary Stockpile
- Ancillary Facilities

### Threatened Flora & Fauna

- Acacia bynoeana
- Acacia pubescens
- Grevillea parviflora subsp. parviflora
- Hibbertia fumana
- Hibbertia puberula subsp. puberula
- Persoonia nutans
- Myotis macropus
- Mormopterus norfolkensis
- Miniopterus schreibersii oceanensis
- Pteropus poliocephalus
- Southern Myotis
- Hollow Bearing Trees (EIS)
- Hollow Bearing Trees (Pre Clearance Surveys)

Rail Link

### Vegetation Community

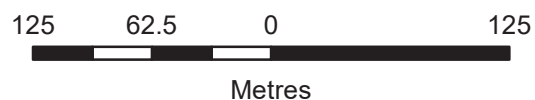
- Castlereagh Scribbly Gum
- Woodland in the Sydney Basin Bioregion
- Castlereagh Swamp Woodland Community
- Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion
- Cumberland Plain Woodland in the Sydney Basin Bioregion
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- Shale Gravel Transition Forest in the Sydney Basin Bioregion
- Water Course

Refer to  
Glenfield Waste Project Specific Procedure  
for specific requirements

Refer to  
Glenfield Waste Project Specific Procedure

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## SIMTA Moorebank Intermodal Terminal Stage 1 - Rail Link Ecology Constraints Sensitive Area Map







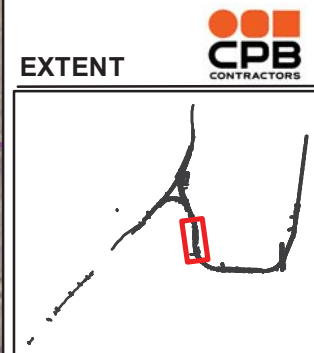
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Glenfield Waste Project Specific Procedure  
for specific requirements

Refer to  
Glenfield Waste Project Specific Procedure  
for specific requirements

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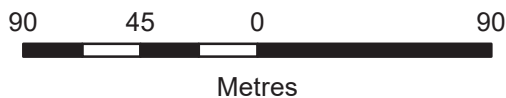
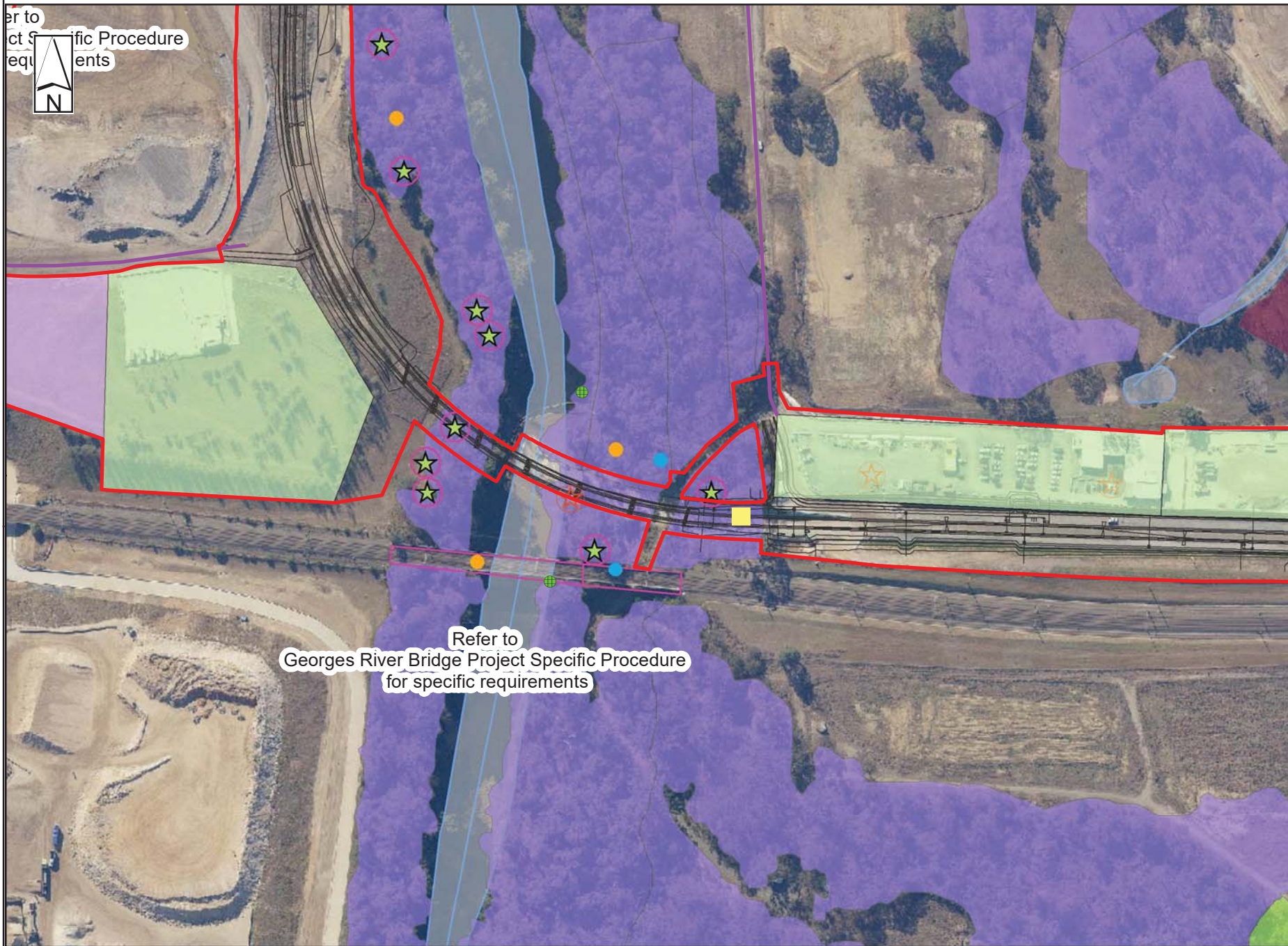
## SIMTA Moorebank Intermodal Terminal Stage 1 - Rail Link Ecology Constraints Sensitive Area Map



### LEGEND


- Surface Water Monitoring
- Construction Boundary
- MA14 Salvage Footprint
- Project Access Roads
- RAE Stockpile Site
- Crushing stockpile site
- GWS Temporary Stockpile
- Ancillary Facilities
- Threatened Flora & Fauna**
  - Acacia bynoeana
  - Acacia pubescens
  - Grevillea parviflora subsp. parviflora
  - Hibbertia fumana
  - Hibbertia puberula subsp. puberula
  - Persoonia nutans
  - Myotis macropus
  - Mormopterus norfolkensis
  - Miniopterus schreibersii oceanensis
  - Pteropus poliocephalus
  - Southern Myotis
  - Hollow Bearing Trees (EIS)
  - Hollow Bearing Trees (Pre Clearance Surveys)
- Rail Link
- Vegetation Community**
  - Castlereagh Scribbly Gum
  - Woodland in the Sydney Basin Bioregion
  - Castlereagh Swamp Woodland Community
  - Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion
  - Cumberland Plain Woodland in the Sydney Basin Bioregion
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  - River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
  - Shale Gravel Transition Forest in the Sydney Basin Bioregion
  - Water Course



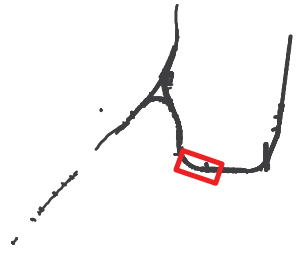


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## SIMTA Moorebank Intermodal Terminal Stage 1 - Rail Link Ecology Constraints Sensitive Area Map



**EXTENT**



### LEGEND

- Surface Water Monitoring
- Construction Boundary
- MA14 Salvage Footprint
- Project Access Roads
- RAE Stockpile Site
- Crushing stockpile site
- GWS Temporary Stockpile
- Ancillary Facilities

#### Threatened Flora & Fauna

- Acacia bynoeana
- Acacia pubescens
- Grevillea parviflora subsp. parviflora
- Hibbertia fumana
- Hibbertia puberula subsp. puberula
- Persoonia nutans
- Myotis macropus
- Mormopterus norfolkensis
- Miniopterus schreibersii oceanensis
- Pteropus poliocephalus
- Southern Myotis
- Hollow Bearing Trees (EIS)
- Hollow Bearing Trees (Pre Clearance Surveys)

Rail Link

#### Vegetation Community

- Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion
- Castlereagh Swamp Woodland Community
- Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion
- Cumberland Plain Woodland in the Sydney Basin Bioregion
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- Shale Gravel Transition Forest in the Sydney Basin Bioregion
- Water Course

**Page 4 of 7**





## EXTENT



## LEGEND

- Surface Water Monitoring
- Construction Boundary
- MA14 Salvage Footprint
- Project Access Roads
- RAE Stockpile Site
- Crushing stockpile site
- GWS Temporary Stockpile
- Ancillary Facilities
- Threatened Flora & Fauna**
  - *Acacia bynoeana*
  - *Acacia pubescens*
  - *Grevillea parviflora* subsp. *parviflora*
  - *Hibbertia fumana*
  - *Hibbertia puberula* subsp. *puberula*
  - *Persoonia nutans*
  - *Myotis macropus*
  - *Mormopterus norfolkensis*
  - *Miniopterus schreibersii oceanensis*
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  - ★ Hollow Bearing Trees (EIS)
  - ★ Hollow Bearing Trees (Pre Clearance Surveys)
- Rail Link
- Vegetation Community**
  - Castlereagh Scribbly Gum
  - Woodland in the Sydney Basin Bioregion
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  - Shale Gravel Transition Forest in the Sydney Basin Bioregion
  - Water Course

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Metres

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# SIMTA Moorebank Intermodal Terminal Stage 1 - Rail Link Ecology Constraints Sensitive Area Map





Refer to  
Anzac Creek Culvert Project Specific Procedure  
for specific requirements



## LEGEND

- Surface Water Monitoring
- Construction Boundary
- MA14 Salvage Footprint
- Project Access Roads
- RAE Stockpile Site
- Crushing stockpile site
- GWS Temporary Stockpile
- Ancillary Facilities
- Threatened Flora & Fauna**
  - Acacia bynoeana
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  - Hibbertia fumana
  - Hibbertia puberula subsp. puberula
  - Persoonia nutans
  - Myotis macropus
  - Mormopterus norfolkensis
  - Miniopterus schreibersii oceanensis
  - Pteropus poliocephalus
  - Southern Myotis
  - Hollow Bearing Trees (EIS)
  - Hollow Bearing Trees (Pre Clearance Surveys)
- Vegetation Community**
  - Castlereagh Scribbly Gum
  - Woodland in the Sydney Basin Bioregion
  - Castlereagh Swamp Woodland Community
  - Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion
  - Cumberland Plain Woodland in the Sydney Basin Bioregion
  - Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
  - River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
  - Shale Gravel Transition Forest in the Sydney Basin Bioregion
  - Water Course

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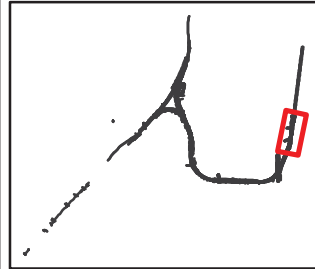
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Datum: GDA 1994  
Date: 6/12/2018  
Service Layer Credits:  
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## SIMTA Moorebank Intermodal Terminal Stage 1 - Rail Link Ecology Constraints Sensitive Area Map





## EXTENT



## LEGEND

- Surface Water Monitoring
- Construction Boundary
- MA14 Salvage Footprint
- Project Access Roads
- RAE Stockpile Site
- Crushing stockpile site
- GWS Temporary Stockpile
- Ancillary Facilities
- Threatened Flora & Fauna**
  - Acacia bynoeana
  - Acacia pubescens
  - Grevillea parviflora subsp. parviflora
  - Hibbertia fumana
  - Hibbertia puberula subsp. puberula
  - Persoonia nutans
  - Myotis macropus
  - Mormopterus norfolkensis
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  - Shale Gravel Transition Forest in the Sydney Basin Bioregion
  - Water Course

Refer to  
Anzac Creek Culvert Project Specific Procedure  
for specific requirements

120 60 0 120  
Metres

Coordinate System: GDA 1994 MGA Zone 56  
Projection: Transverse Mercator  
Datum: GDA 1994  
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## SIMTA Moorebank Intermodal Terminal Stage 1 - Rail Link Ecology Constraints Sensitive Area Map



## **Attachment D: Stakeholder Consultation Response**

## **Attachment E: Weed Management Strategy**

# Weed Management Strategy

Moorebank Precinct East Stage 1 – RALP No. 1

<b>Project number:</b>	N01031
<b>Document number:</b>	EN-PLN-0018
<b>Revision date:</b>	18 October 2018
<b>Revision:</b>	03

## Document Approval

Rev.	Date	Prepared by	Reviewed by	Approved by	Remarks
A	3 Mar 2016				Initial draft
B	6 Jun 2016				Updated to address SIMTA comments
C	15 Jul 2016				For SIMTA's second review
D	21 Dec 2016				Updated to address final CoAs and for consultation
E	6 Feb 2017				Updated to address consultation comments
F/00	6 Apr 2017				Updated based on comments – Approved by DP&E
01	30 Nov 2017				Review update
02	18 May 2018				Review update legislation
03	18 Oct 2018				Boundary update

Rev.	Date	Prepared by	Reviewed by	Approved by	Remarks
Signature:					

## Details of Revision Amendments and Authorship

### Document Control

The Project Director is responsible for ensuring that this strategy is reviewed and approved. The Environment Manager is responsible for updating this strategy to reflect changes to legal and other requirements, as required.

### Amendments

Any revisions or amendments must be approved by the Project Director before being distributed / implemented.

### Revision Details

Revision	Details
A	Initial draft for SIMTA review
B	Updated to address comments from CPB and SIMTA
C	For SIMTA's second review
D	Updated to address final CoAs and for consultation
E	Updated to address consultation comments
F/00	Updated in response to comments from DP&E and for re-submission Approved by DP&E
01	Updated during review for EPL update
02	Updated legislation section
03	Boundary update

### Document Authors, Reviewers and Qualifications

This document has been prepared and reviewed by appropriately qualified professionals as detailed below.

Author's Name	Qualifications
[REDACTED]	Bachelor of Science in Environmental Biology (Honours), University of Newcastle Upon Tyne, UK BioBanking, Biodiversity Certification and Major Projects Offsets Accredited Assessor Ecological Consultants Association of New South Wales – Practicing Member
[REDACTED]	Master of Environmental Engineering Management, University of Technology Sydney Bachelor of Engineering, University of Technology Sydney
[REDACTED]	Master of Science, Environmental Management, University of Cape Town
[REDACTED]	Master of Environmental Engineering Management, University of Technology Sydney Bachelor of Engineering (Civil & Environmental), University of Technology Sydney
[REDACTED]	Master of Environmental Science and Law, University of Sydney Bachelor of Science, University of Sydney
[REDACTED]	Bachelor of Business Administration majoring in Environmental Resource Management, Macquarie University Post Graduate Diploma in Safety Science, University of New South Wales

Author's Name	Qualifications
	Masters of Applied Science in Environmental Science, Sydney University
	Bachelor of Engineering in Environmental Engineering (Honours), University of Western Australia

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# Weed Management Strategy

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## 1. Overview

### 1.1 Background

The purpose of this Weed Management Strategy (WMS) is to ensure that the potential impacts of the Rail Link project (including the Rail Link and ancillary facilities) on weed management are minimised. The scope of this WMS has been determined based on the recommendations and conditions presented below:

- Conditions of Approval under SSD-6676 SIMTA Intermodal Terminal Facility – Stage 1 (NSW)
- Stage 1 Environmental Impact Statement
- Stage 1 Response to Submissions Report (including Final Compilation of Mitigation Measures)
- Conditions of Approval under MP10\_0193 SIMTA Moorebank Intermodal Terminal Facility – Concept Plan (NSW)
- NSW Concept Plan Environmental Impact Statement
- NSW Concept Plan Submissions Report (including Revised Statement of Commitments)
- Conditions of Approval under EPBC 2011/6229 SIMTA Intermodal Terminal (Commonwealth)
- Commonwealth Concept Plan EIS
- Other applicable legislative obligations
- CPB Management System

### 1.2 Project Scope

SIMTA's Moorebank Intermodal Terminal Development involves the construction and operation of the necessary infrastructure to support a container freight road volume of 250,000 twenty-foot equivalent units (TEU).

CPB Contractors' scope of work specifically applies to Stage 1 – RALP No. 1 which consists of a 2.8 kilometre rail line, along with its required infrastructure, to connect the Import-Export Terminal and Interstate Terminals to the Southern Sydney Freight Line (SSFL), and capable of accommodating trains up to 1,800m in length.

The SIMTA site is located in the Liverpool local government area. It is 27 kilometres south-west of the Sydney Central Business District (CBD), 26 kilometres west of Port Botany, 16 kilometres south of the Parramatta CBD, 0.6 kilometres from the M5 South-West Motorway, five kilometres east of the M5 South-West Motorway / Westlink M7 Motorway Interchange and connecting to the main north-south rail line via the Southern Sydney Freight Line.

The Moorebank Intermodal Terminal Development – RALP No. 1 is the first package of Stage 1 of the overall project and its construction will include:

- A northbound connection and a southbound connection to the SSFL
- Civil and earthworks, including remediation works and benching
- A Reinforced Earth Embankment (RE-Wall) a section of the Glenfield Waste Services landfill site
- A bridge over the Georges River
- A culvert crossing over Anzac Creek
- Installation of new Moorebank Avenue overbridge
- Service relocation and protection
- Track work
- Signalling systems
- Security fencing

An indicative map of the Project is provided in Figure 1 below.

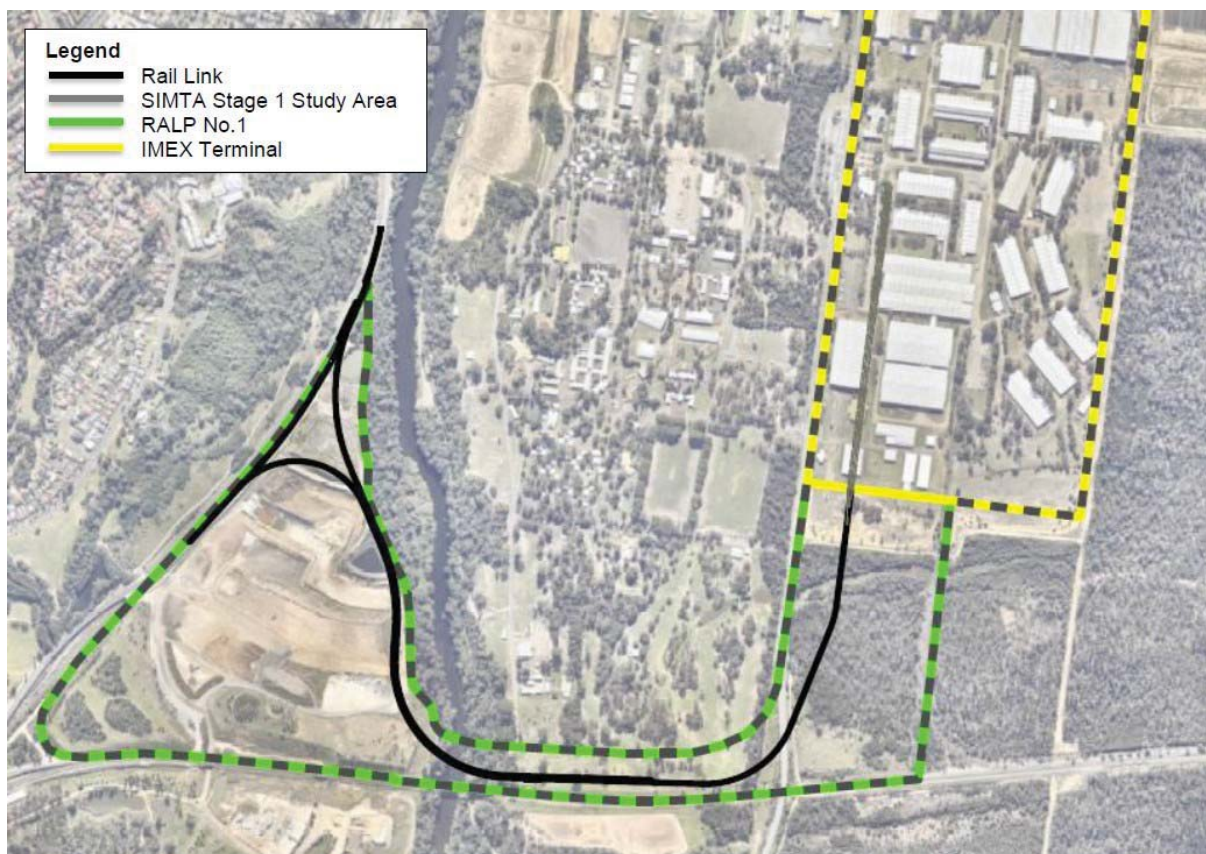


Figure 1: Indicative Project Map

### 1.3 Objectives

The objectives and targets of the WMS are included in the Construction Flora and Fauna Management Plan (CFFMP). The WMS outlines the framework for treating noxious weeds within the Rail Link project and adjoining area (the study area). While the focus of the WMS is the treatment of noxious weeds, this WMS also provides for the treatment of other exotic species that are not noxious. More specifically the key outcomes are to:

- Provide a framework for weed management
- Provide species specific control options
- Identify an appropriate monitoring strategy for assessing the success of implementation
- Provide performance criteria to be upheld
- Provide a strategy for adaptive management to ensure that non-compliances can be managed effectively
- Manage the construction area to enable long term eradication of weed species

### 1.4 Interactions with Other Management Plans

This WMS is a sub strategy to the Construction Flora and Fauna Management Plan, which is itself a sub plan to the Construction Environmental Management Plan (CEMP). The CFFMP sets out interactions of this WMS with the other management sub plans that will be implemented on the Rail Link project. Figure 2 below shows these interactions.

This WMS makes reference to and should be read in conjunction with several key project documents including:

- Construction Flora and Fauna Management Plan (CPB 2016)
- Riparian Vegetation Management Plan (Hyder Consulting 2015)
- Threatened Flora Species Management Plan (Hyder Consulting 2015)



Figure 2: Environmental Documents Map

## 2. Legal and Other Requirements

### 2.1 Conditions of Project Environmental Approvals

The compliance of this document with the various environmental approval documents is demonstrated in Annexure A.

### 2.2 Relevant Legislation

The Rail Link project is designated State Significant Development (SSD) and has been assessed under Part 4 Division 4.1 of the *Environment Planning and Assessment Act 1979* (EP&A Act). Key legislation relevant to the management of weeds for the Rail Link project includes:

- *Biosecurity Act 2015 (repeals Noxious Weeds Act 1993)* (NSW Act)
- *Pesticides Act 1999*

### 2.3 Guidelines

Various guidelines that apply to the weed management strategy on the Rail Link Project include:

- A Field Manual for the Surveying and Mapping of Nationally Significant Weeds (McNaught, Thackway, Brown and Parsons, 2008).
- Asparagus Weeds Best Practice Management Manual (Department of Water, Land and Biodiversity Conservation, 2006).
- Lantana: Best Practice Manual and Decision Support Tool (Australian Government Department of Agriculture, Fisheries and Forestry, 2009).
- Cumberland Plain Recovery Plan (Department of Environment, Climate Change and Water, 2011).
- Noxious and Environmental Weed Control Handbook, 6th Edition, (Department of Primary Industries 2014).
- NSW WeedWise profiles for noxious and environmental weeds (Department of Primary Industries 2016).
- Recovering Bushland on the Cumberland Plain. Best practice guidelines for the management and restoration of bushland (DECC 2005).
- Australian Standard, 2009. AS 4970–2009 Protection of trees on development sites.
- The Australian Weed Strategy (Natural Resource Management Ministerial Council 2006).

### 2.4 Additional Permits and Licences

Additional permits or licences that may be required in relation to the management of weeds on the construction of the Rail Link include:

- Appropriate APVMA permits for herbicide use, particularly if a non-registered use is proposed (i.e. for Alligator Weed).
- Permit from DPI to remove and transport Alligator Weed.



### 3. Roles and Responsibilities

The roles and responsibilities specific to Weed Management are provided in Table 1 below.

Table 1: Role and Responsibilities

Role	Responsibility
Environment Manager	<ul style="list-style-type: none"> <li>Issue herbicide application approvals</li> <li>Coordinate project team, Bush Regeneration Contractor and Project Ecologist as required</li> </ul>
Environmental Coordinator	<ul style="list-style-type: none"> <li>Identify, manage and dispose of weeds</li> <li>Prepare Site Environment Plans (SEP)</li> <li>Complete pre-clearing checklists</li> </ul>
Project Ecologist	<ul style="list-style-type: none"> <li>Site inspections</li> <li>Recommend mitigation measures</li> <li>Complete a pre-clearing checklist</li> <li>Performance indicator monitoring</li> <li>Provision of technical advice</li> </ul>
Bush Regeneration Contractor	<ul style="list-style-type: none"> <li>On the ground works associated with this WMS</li> <li>Maintenance inspections</li> <li>Reporting on performance against criteria</li> </ul>
Site Supervisor	<ul style="list-style-type: none"> <li>Identify, manage and dispose of weeds</li> <li>Stabilisation of area</li> <li>Implement weed control measures</li> </ul>

Herbicide application will only be undertaken by appropriately trained (minimum ChemCert Level 2) and experienced personnel.

#### 3.1 Training

Prior to commencing work on the Rail Link project, all relevant staff will attend the project induction. The project induction will include the following as a minimum with respect to weed management:

- A summary of the noxious weeds likely to occur (previously recorded) within the Rail Link to assist with identification by construction contractors.
- Details of threatened species likely to be encountered during construction and weed control activities (particularly Small-flowered Grevillea and Nodding Geebung to be preserved).
- The locations of known populations of threatened species.
- The process that has been implemented for delineation of the clearing boundaries.

## 4. Existing Environment

The information presented in this section has been compiled based on the findings of the Stage 1 EIS, which details the biodiversity values of the Rail Link project. This includes a comprehensive list of the exotic species recorded, including those listed as noxious within the Liverpool Local Government Area (LGA).

The requirements of the Riparian Vegetation Management Plan (Hyder 2015) prepared as part of the SIMTA Stage EIS have been incorporated into this WMS.

### 4.1 Exotic Species

Ecological surveys conducted for the Stage 1 EIS recorded a total of 310 vascular plant species which included 213 local native species, eight non-local native species and 89 exotic species. A comprehensive list of plant species recorded during those surveys is provided in the Stage 1 EIS.

Some level of recruitment of exotic species was noted in all of the vegetation types recorded within the Rail Link project. The level of weed infestation is proportionate to the level of historical disturbance and edge effects. These were highest at the north-eastern end of the Rail Link project, where the *Landscaped Areas* community was recorded, and along the southern and western portions, where the *Cleared and Disturbed* community was recorded (see Figure 3).

The *Landscaped Areas* community was noted as containing predominantly planted native (both endemic and non-endemic) and exotic trees over an understorey of mown exotic grasses. Likewise, the *Cleared and Disturbed* vegetation along the western portion is located within and adjacent to Glenfield Waste Facility which is a highly modified landscape. Removal of native canopy and disturbance to natural soil profiles has allowed a proliferation of exotic herbs and grasses.

### 4.2 Noxious Weeds

The Biosecurity Act 2015 sets out the regulatory framework for controlling noxious weeds in NSW.

Division 2 of the Biosecurity Act defines local control authorities for weeds and Schedule 1 outlines special provisions relating to weeds, including the duty of land occupiers to control and manage weeds. A comprehensive list of exotic species that are declared noxious within the Liverpool LGA is available through the NSW DPI WeedWise website ([weeds.dpi.nsw.gov.au](http://weeds.dpi.nsw.gov.au)). As such, they are responsible for controlling noxious weeds on all council owned land. The council is also responsible for enforcing the control of noxious weeds on private property and reporting to the Minister.

Each species is grouped into a noxious weed class based on the threat that it poses to environmental, agricultural or personal resources. Details of the five noxious weed control classes that may be applied to a species by a weed control order are provided in Table 2. Note that the quoted legal requirements are indicative only, as a species may have additional legal requirements to the ones outlined below which may only be relevant to specific LGAs.

Table 2: Noxious Weed Control Classes

Control Class	Threats	Typical legal requirements
Class 1: State Prohibited Weeds	Plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.	<i>The plant must be eradicated from the land and the land must be kept free of the plant.</i> <i>The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.</i>
Class 2: Regionally Prohibited Weeds	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.	<i>The plant must be eradicated from the land and the land must be kept free of the plant.</i> <i>The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.</i>
Class 3: Regionally	Plants that pose a serious threat to primary production or the environment of an area to which the order applies, are not widely	<i>The plant must be fully and continuously suppressed and destroyed.</i>



Control Class	Threats	Typical legal requirements
Controlled Weeds	distributed in the area and are likely to spread in the area or to another area.	
Class 4: Locally Controlled Weeds	Plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.	<i>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</i>
Class 5: Restricted Plants	Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.	No control requirements apply to Class 5 weeds, however, the weeds are "notifiable" and there are restrictions on their sale and movement.

Of the 89 exotic species that were recorded during the ecological surveys for the Stage 1 EIS, 13 of these are listed as noxious within the Liverpool LGA. The control class for each of these species, along with control methods are outlined in outlined in Table 3.

### 4.3 Weeds of National Significance

Weeds of National Significance (WoNS) are nationally agreed priority plant species for control and management. Species that are included in the list of WoNS are selected based on their scores for invasiveness, potential to spread, and impact on socioeconomic and environmental assets. There are currently 32 species on the list of WoNS, 20 that were added on the inaugural list and 12 that have been subsequently added. The WoNS that were identified within the Rail Link project are outlined in Table 3.

### 4.4 Aquatic Weeds

The Stage 1 EIS noted a proliferation of the aquatic weeds Alligator Weed *Alternanthera philoxeroides* (noxious) and Parrots Feather *Myriophyllum aquaticum* within the channel of Anzac Creek. Due to the highly aggressive nature of Alligator Weed and the potential for it to spread beyond the riparian and aquatic environment (albeit less readily) and occur within the Rail Link project, control measures have been included in this WMS for control methods of Alligator weed within riparian and aquatic environments.



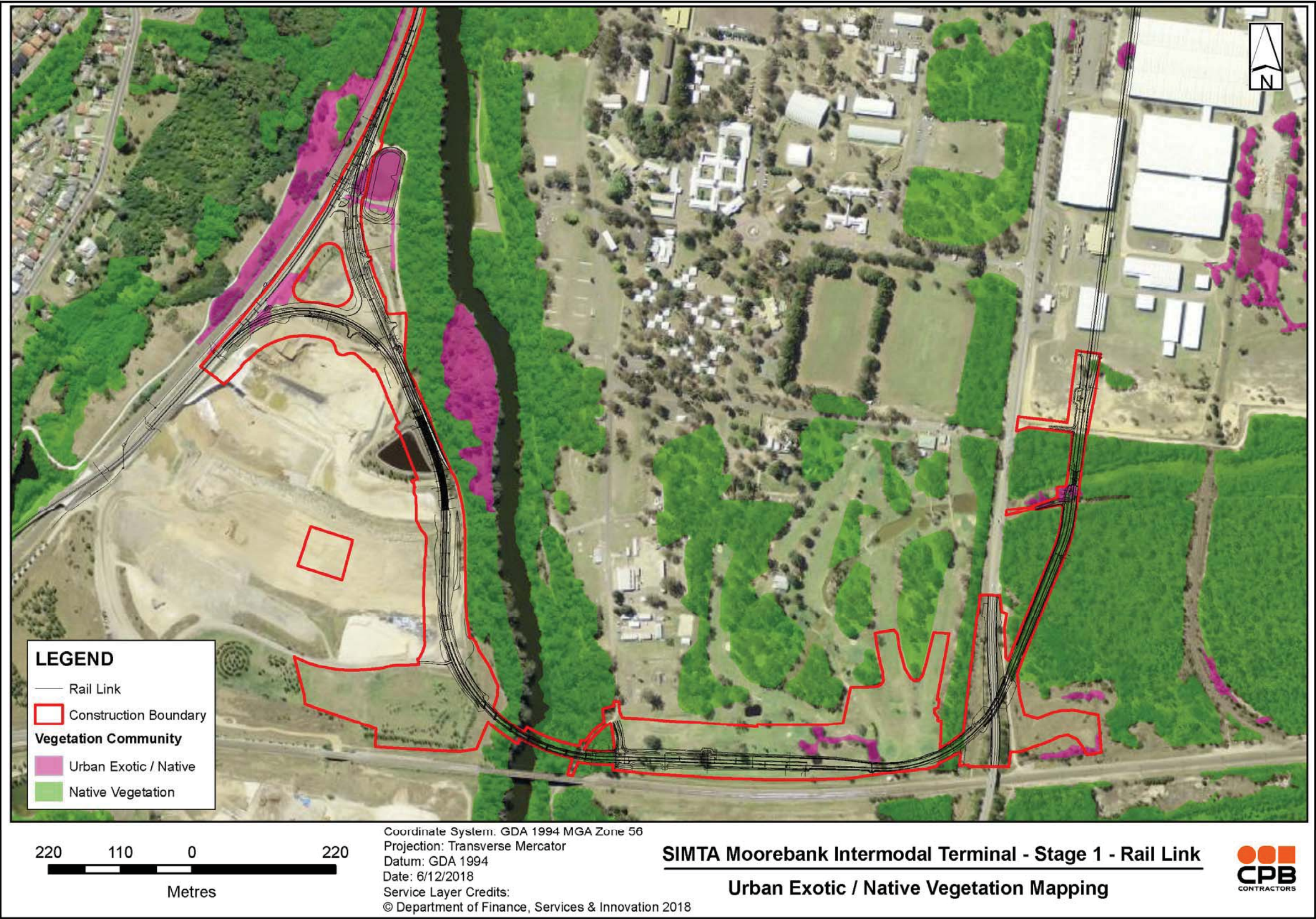


Figure 3: Vegetation Mapping – Urban / Exotics Species & Native Vegetation



## 5. Weed Control Procedure

### 5.1 Pre-clearance Assessment

The procedure for conducting pre-clearance assessments is detailed within the CFFMP. Specifically relevant to this WMS, identification of noxious weeds will be undertaken as part of the pre-clearing assessments.

- The vegetation clearing boundary is to be fenced pre-construction, so that the area to clear can be readily identified.
- Individual and isolated occurrence of noxious weeds will be marked with points and recorded using a handheld GPS unit or similar.
- Dense infestations of single or multiple weeds can be marked using an encompassing polygon (recorded using a handheld GPS or similar) in combination with a list of species recorded within it.
- Noxious weeds may be marked with spray paint or similar prior to clearing.

### 5.2 Notification and Consultation

As the representative for the Local Control Authority, the Liverpool City Council (LCC) Weed Officer will be consulted and notified of the occurrence of noxious weeds within the Rail Link project.

### 5.3 Weed Control Methods

The control methods described below provide context for the species specific requirements in Table 3. It is noted that there will be two approaches to weed control for the Rail Link Project. Weed control within the project construction boundary would typically be broad scale and likely include mechanical control and less targeted herbicide techniques (such as foliar spraying). Weed control, where necessary, in adjoining land would require a more targeted and environmentally sensitive approach, favouring techniques such as physical control or highly focussed herbicide application (cut stump or scrape and paint). Likewise, when working in proximity to sensitive areas (such as waterways and threatened species) appropriate weed control techniques should be used to minimise the risk to the environment.

The application of integrated weed control methods has led to the development of contemporary and novel techniques that, although effective, have not been included in this strategy. The techniques detailed below are adapted from those described in the Noxious and Environmental Weed Control Handbook (DPI 2105) amongst other sources. All weed control activities shall be undertaken by qualified and/or experienced bush regenerators from a reputable contractor.

It is noted that the Project BAR highlights the presence of some large thickets of Lantana (*Lantana camara*), particularly along the Georges River riparian corridor. Although also a noxious weed, these lantana thickets (and some other woody weeds) can provide foraging and nesting habitat for birds and arboreal mammals. A staged clearing approach will be implemented for these exotic thickets to minimise disturbance to native fauna.

#### 5.3.1 Mechanical Control

Mechanical weed control provides a rapid and effective way of controlling broad scale weeds and removing topsoil likely to contain noxious weed propagules from site. Heavy machinery (such as a dozer or excavator) can be used to scrape the vegetation and topsoil and have it removed immediately from site to an appropriate waste facility. This technique is appropriate for clearing the more degraded sections of the Rail Link project (particularly the *Landscaped Vegetation* and *Disturbed Land*). In the Southern Boot Land, where a large number of ecological constraints adjoin the area of vegetation to be cleared, hand held equipment may be more appropriate in order to safeguard threatened species and fauna habitat.

Another option is the reburial of weeds on site, if the space is available and appropriate. Appropriate locations include areas that do not pose a potential risk of cross contamination (e.g. not near waterways or areas of protected native vegetation) and areas that are not proposed for future ground disturbance. It can often be appropriate to combine mechanical control with chemical control, including for reburial, as this minimises the potential for cross contamination.

### 5.3.2 Physical control

Physical removal is typically used for smaller infestations of sensitive areas where herbicide application would not be appropriate. Physical control includes removal both by hand and using small hand tools such as secateurs, loppers, mattocks and brush cutters. Appendix 4 of *Recovering bushland on the Cumberland Plain Best practice guidelines for the management and restoration of bushland* (DEC 2005) provides a detailed description of appropriate hand removal techniques for an array of weed types.

### 5.3.3 Chemical Control

In a variety of situations herbicides offer the only viable method for control of a species. This may be due to practical constraints that limit the ability to use other techniques or because the species itself is aggressive and not controlled by other means. Herbicide application will be carried out in accordance with the NSW Pesticides Regulation 2009. Furthermore, it shall be completed with reference to and in accordance with the herbicide label and/or the Environmental and Noxious Weed Control Handbook (DPI 2015). Herbicide application will be undertaken by appropriately trained (minimum ChemCert Level 2) and experienced personnel. No chemical control is to be undertaken within five metres of known populations of Small-flowered Grevillea or Nodding Geebung that are to be retained.

#### Foliar spraying

Herbicides are diluted with an appropriate solvent to the specified concentration. Foliage must be sprayed until wetted but should avoid any runoff. Plant species typically require 80 – 90% coverage to ensure success. Overspray leads to off target mortality so this should be minimised by: not spraying over 1.5 metres, not spraying during windy conditions and using selective herbicides where appropriate. Smaller infestations and follow up weeding can be completed using a knapsack sprayer whereas larger application may be more suited to a Quik Spray® unit or boom sprayer.

#### Stem injection, basal bark spraying and ringbarking

Stem injection and ringbarking involve exposing the cambium layer (sapwood tissue) and applying herbicide directly to it. Stem injection typically requires the drilling of holes around the circumference of the tree whereas ringbarking utilises a chainsaw to cut a groove. Herbicide is applied neat and if done correctly, the potential for off target mortality is likely to be nil. Likewise, the volume of herbicide used is considerably lower than foliar spraying. This technique is useful where noxious woody weeds are providing fauna habitat that would otherwise be lost by felling and chipping.

Basal bark application typically requires the use of diesel as a solvent for the herbicide or the addition of a surfactant to the spray. This technique uses less herbicide than foliar spray but suffers from similar overspray problems.

#### Cut stump application

The plant is cut off completely at its base using appropriate means and immediately treated with herbicide. It has similar benefits to stem injection/ringbarking in achieving low off target mortality, however in some instances it is only successful on smaller plants. The time between cutting and application must be minimised to the fullest extent practicable, which can present safety risks on larger plants; where chainsaws are required.

The herbicide solution must be applied, as soon as the trunk or stem is cut. Two operators working as a team can use this method effectively.

#### Splatter packs

Lantana, and some other noxious weeds, can be effectively controlled using a splatter pack. A splatter pack is a modified cattle drenching gun that uses a propellant to deploy a stream of herbicide. Off target mortality is typically less than foliar spraying since the droplets of herbicide are larger and less susceptible to wind drift.

## 5.4 Species Specific Requirements

Table 3 contains the control methods for all noxious weeds recorded during surveys from the Stage 1 EIS. Control methods have been summarised from the information available in the Noxious and Environmental Weed Control Handbook (DPI 2015).

Table 3: Control Methods for Noxious Weeds Recorded During Ecological Surveys for the Stage 1 EIS

Species	Common Name	Class	WoNS	Recorded Location	Control Information
<i>Alternanthera philoxeroides</i>	Alligator Weed		Yes	Anzac Creek, wetlands on western side of Georges River	Chemical control. Note that a permit from NSW DPI is required to remove and transport Alligator Weed. Reburial is a possible option after chemical control if advised as appropriate by qualified personnel.
<i>Asparagus asparagoides</i>	*Bridal Creeper	4	Yes	Banks of Georges River	Mechanical removal or herbicide application by foliar spray
<i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i>	Bitou Bush	4	Yes	Disturbed edges of bushland south of SIMTA site and east of SME Golf Course on MIC site	Mechanical removal of juvenile plants or herbicide application by cut and paint stump, foliar spray
<i>Cortaderia selloana</i>	Pampas Grass	3	No	Disturbed area in the southern disturbed part of the Boot Land	Mechanical removal where possible is preferred. One chemical control option.
<i>Lantana camara</i>	*Lantana	4	Yes	Banks of Georges River	Mechanical removal
<i>Ligustrum lucidum</i>	Privet (Broad-leaf)	4	No	Western bank of Georges River	Mechanical removal or herbicide application – cut and paint stump, drill and inject
<i>Ligustrum sinense</i>	Privet (Narrow-leaf)	4	No	Banks of Georges River	Mechanical removal or herbicide application – cut and paint stump, drill and inject.
<i>Ludwigia peruviana</i>	Peruvian Primrose	3	No	Anzac Creek, in wetland on western side of Georges River	Mechanical removal or herbicide application –foliar spray
<i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive	4	No	Banks of Georges River	Mechanical removal or herbicide application – cut and paint stump, drill and inject, foliar spray, basal bark spray
<i>Opuntia</i> spp.	Prickly Pear	4	Yes	Banks of Georges River	Mechanical removal
<i>Rubus fruticosus</i> agg. <i>Spp.</i>	Blackberry	4	Yes	Banks of Georges River, in disturbed bushland south of Anzac Creek	Mechanical removal or herbicide application –foliar spray
<i>Salix alba</i>	Willow	5	Yes	In wetland on western side of Georges River	Mechanical removal ensuring all of the root material is removed. Herbicide application either by foliar spray, cut stump or stem injection
<i>Salvinia molesta</i>	Salvinia	2	Yes	On Anzac Creek adjacent to existing culvert	Small infestations can be mechanically controlled. Herbicide application by foliar spraying for larger infestations.

## 5.5 Integrated Weed Management

Weed management is most effective when an integrated approach is taken, using a number of different approaches for each species. This may be a combination of mechanical and chemical control.

## 5.6 Disposal of Weeds and Topsoil

Vegetative material and topsoil that contains, or is likely to contain noxious weeds and propagules must be disposed of at an appropriate waste facility that accepts such material. The nearest facilities are located at:

- Chullora (15 Muir Rd, Chullora NSW 2190)
- Lucas Heights (New Illawarra Rd, Lucas Heights NSW 2234)

It is noted that a permit is required from DPI to remove and transport Alligator Weed and there are stringent controls regarding its disposal.

Stockpiling of vegetative material and topsoil will be minimised and removed from site as soon as practicable. Soil stripped and stockpiled from areas containing known weed infestations is to be stored separately on cleared land at least 40 m from native vegetation and is not to be moved to areas free of weeds.

## 5.7 Weed Management Actions

Weed management actions that will be implemented as part of CPB Contractors' work in the construction area and its immediate vicinity are identified in Table 4 below. These are in line with the requirements of the Riparian Vegetation Management Plan.

Table 4: Summary of Weed Management Actions

Action	Timing		Frequency	Outcome
	Pre-clearing	Construction / clearing		
Primary weed control of the construction area	✓	✓	Monthly prior to and during construction period	Removal of dense weed cover from management sites (where practical)
Management of noxious weeds us to be undertaken in accordance with the <i>Biosecurity Act 2015</i> (repeals <i>Noxious Weeds Act 1993</i> )	✓	✓	As per weed control frequency (monthly)	Prevent weed establishment and invasion
Equipment used for treating weed infestation will be cleaned prior to moving to a new area within the management site to minimise the likelihood of transferring any plant material and soil.	✓	✓	As per weed control frequency (monthly)	Prevent weed establishment and invasion
Soil stripped and stockpiled from areas containing known weed infestations are to be stored on cleared land at least 40m from native vegetation		✓	As soil disturbance occurs	Prevent weed establishment and invasion
Soil excavated from the Anzac Creek corridor must be disposed of in accordance with the guidelines in the Alligator Weed Control Manual		✓	As excavation occurs	Prevent further spread of the noxious weed <i>Alternanthera philoxeroides</i>

Action	Timing		Frequency	Outcome
	Pre-clearing	Construction / clearing		
(DPI 2007), as it will likely contain fragments of Alligator Weed.				



## 6. Hygiene Protocols

The seeds of the noxious weeds recorded within the Rail Link project are predominantly dispersed by the movements of people, wind and water. In order to minimise this dispersal, a process for ensuring hygiene will be implemented. This process is discussed below.

### 6.1 Erosion and Sediment Control

The removal of native and exotic vegetation during clearing activities will leave the topsoil exposed and susceptible to erosion and sedimentation of waterways. Weed propagules present in the topsoil could potentially be transported to areas of vegetation that are currently free from noxious weeds. The Construction Soil and Water Management Plan (CSWMP) addresses the specific management measures that will be implemented to minimise erosion and sedimentation, however some weed specific measures include:

- Spray-grassing of exposed soil and long term topsoil stockpiles with a sterile exotic grass, or ideally a native grass species mix will assist in reducing erosion.
- On steeper slopes and the banks of waterways it may be appropriate to lay jute matting or similar geotextile fabric in order to stabilise the underlying soil.

### 6.2 Vehicle and Personal Wash-down

During vegetation clearing activities and when moving out of areas of weed infestations, a vehicle and personal wash down procedure will be implemented. An “arrive clean, leave clean” mentality will be established when working in native bushland or when dealing with weeds, based on the Department of the Environment’s “Arrive Clean, Leave Clean” guideline.

Designated areas will be established for vehicle wash-down. Vehicle wash-down areas will be bunded, ensuring that water is captured and can be disposed of off-site. If space is available, wheel wash bays over rumble grids will be established. High pressure hoses from water trucks will be used if space is not available for a more permanent set up.

Personnel wash-down clean areas will be established where necessary. Personnel boot washing/cleaning facilities will include washing trays/tubs, hard brushes and a disinfectant solution.

Individual site set-up will be detailed in the site specific work packs, including work method statements and Site Environmental Plans.

## 7. Review and Improvement

An integrated approach to weed control in addition to an adaptive management strategy provide the highest success rates.

The Environment Manager will be responsible for the monitoring of weed control measures for the Rail Link project. Monitoring will be undertaken both within the area cleared for the Rail Link project and in the adjoining land to ensure that further spread of noxious weeds is identified and corrective measures implemented. This is particularly important within the Southern Boot Land, where the Rail Link project will be constructed in close proximity to populations of threatened flora species.

### 7.1 Monitoring and Reporting

Monitoring and review of the WMS will be undertaken six-monthly during the construction of the Project in line the CEMP. Beyond this period, annual reporting would be undertaken by SIMTA as a part of the Biodiversity Offset Package. Monitoring for this WMS will focus on the success of measures undertaken when compared to a number of key performance criteria. The performance criteria are:

- Reduction of the cover of noxious weeds within the Rail Link project to no greater than 5 per cent cover within two years.
- Reduction of the cover of other exotic species within the Rail Link project to no greater than 5 per cent cover within five years.
- Minimise spread of noxious weeds outside of the Rail Link project.
- Zero loss of Small-flowered Grevillea or Nodding Geebung due to off-target herbicide application.

CPB Contractors will manage the construction area with consideration of the objectives identified above.

Monitoring activities will include mapping of noxious weeds in the vicinity of the construction area by applying the same methodology as the pre-clearance assessment (Section 5.1). The intent is to provide a rigorous and replicable means of assessing the success of weed control measures and identifying opportunities for improvement, where necessary. Additional monitoring will be undertaken generally in accordance with Section 8.1 of the CFFMP.

Annual monitoring reports will be prepared to detail the weed control undertaken since the previous report and the status of the weed in the construction area and its immediate vicinity.

#### 7.1.1 Pesticide Application Record

In accordance with the Pesticides Regulation (2009), records of use of herbicides must be maintained for pesticides applied for commercial or occupational purposes allowing each treatment activity.

A copy of the pesticide application record sheet is provided in Annexure C of this WMS.

### 7.2 Adaptive Management

An adaptive management approach involves a process of monitoring, reviewing and then responding to the results of this WMS, so as to ensure that the outcomes are achieved. It will be the responsibility of the Environment Manager, in conjunction with the bush regeneration contractor, to implement a process of adaptive management and continual improvement based on the results of each monitoring cycle. Situations that may require adaptive management include, but are not limited to:

- Ineffectiveness of chosen treatment method on exotic species.
- Unacceptable off-target mortality from chosen technique.
- Treatment of a previously unidentified weed species (this would be in accordance with Noxious and Environmental Weed Control Handbook (DPI 2015) and/or herbicide labels).

## Annexures

### Annexure A: Compliance Matrix

#### Conditions of Project Environmental Approvals

Conditions of approval that specifically address the management of weeds are identified below.

#### Stage 1 Conditions of Approvals

Table 5: Stage 1 Conditions of Approval

Stage 1 CoA Ref	Requirement	Where Addressed
E34 d)	(iv) a Weed Management Strategy, incorporating weed management measures focusing on early identification of invasive weeds and effective management controls (including for those related to aquatic and riparian zones);	This Strategy

#### Stage 1 Final Compilation of Mitigation Measures

Table 6: Stage 1 Final Compilation of Mitigation Measures

Stage 1 FCMM Ref	Requirement	Where Addressed
<b>8</b>	<b>Biodiversity</b>	
8A	A Flora and Fauna Management Plan will be prepared as part of the CEMP. Native vegetation clearing will not occur until the Flora and Fauna Management Plan is approved. The Flora and Fauna Management Plan will include the following measures as a minimum:	CFFMP This Strategy
g)	Management of noxious weeds is to be undertaken in accordance with the <i>Biosecurity Act 2015</i> (repeals <i>Noxious Weeds Act 1993</i> ) and include details relating to the monitoring, management and where necessary eradication of weeds, disposal of green waste, and vehicle/plant weed wash down protocols if required.	Section 2.2 Section 5 Section 6 Section 7
h)	Equipment used for treating weed infestation(s) will be cleaned prior to moving to a new area within the Proposal site to minimise the likelihood of transferring any plant material and soil.	Section 6.2
i)	Soil stripped and stockpiled from areas containing known weed infestations are to be stored on cleared land at least 40 m from native vegetation	Section 5.6
j)	Water from the truck wash down in the Rail East Compound will be captured and disposed of offsite to prevent weed spread to adjoining native vegetation	Section 6.2

#### Commonwealth Concept Plan Conditions of Approval

Table 7: Commonwealth Concept Plan Conditions of Approval

Commonwealth CoA Ref	Requirement	Where Addressed
<b>5</b>	<b>Flora and Fauna Management Plan</b>	
h)	Measures to safeguard flora and fauna from the threat of weeds, fire, pathogens and unauthorised access, including (but not limited to) the commitments outlined in section 7.4.1 of the EIS (and summarised at Annexure A);	This Strategy Section 5 Section 6

## Annexures

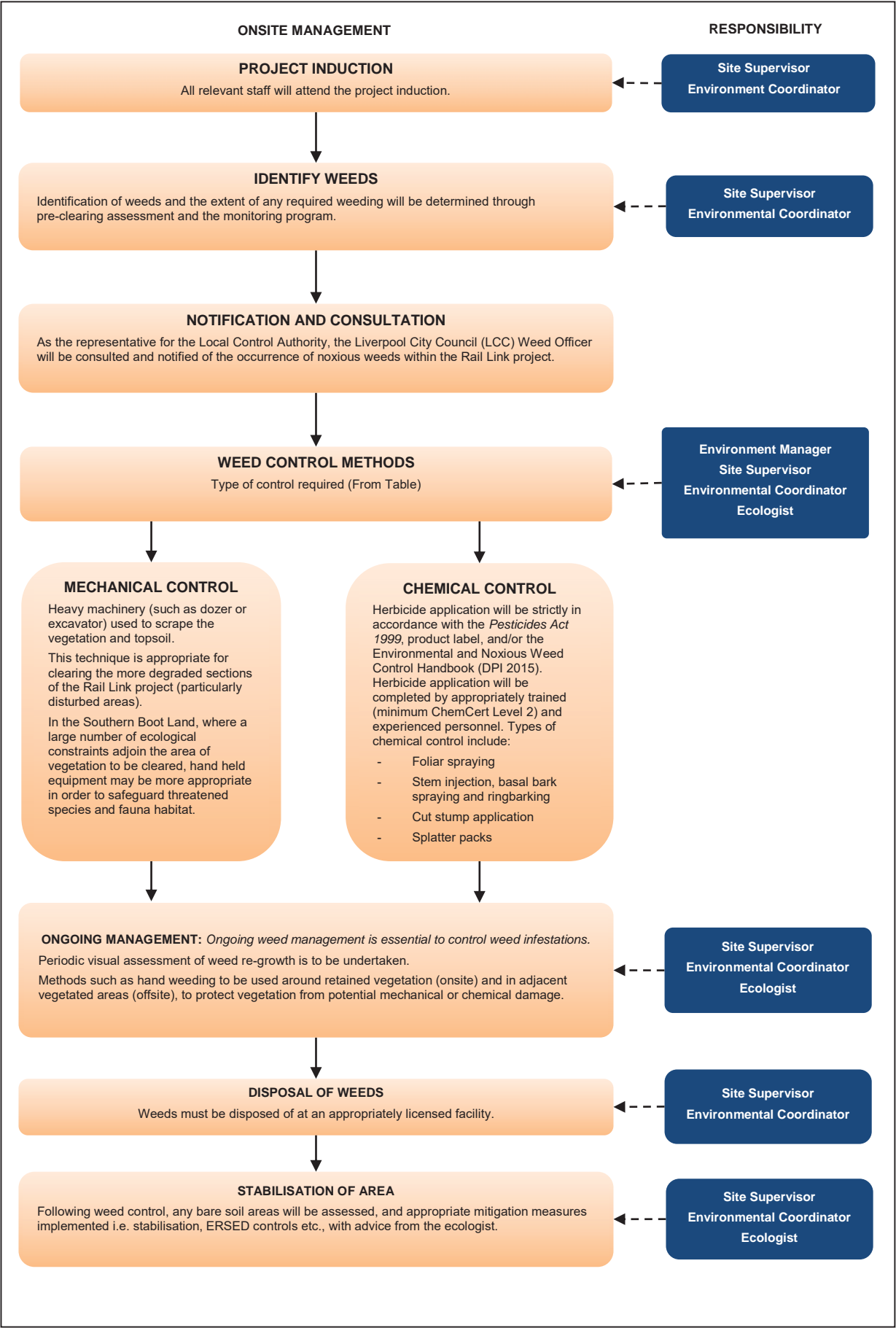
## Commonwealth Concept Plan Mitigation Measures

Table 8: Commonwealth Concept Plan Mitigation Measures

C'th Concept Plan MM Ref	Requirement	Where Addressed
<b>7.4.1</b>	<b>Biodiversity</b>	
7.4.1.3	Mitigate	
i)	Management of weeds in and adjacent to cleared areas will occur in accordance with a Weed Management Plan. This plan will include details relating to the monitoring, management and where necessary eradication of weeds, disposal of green waste, and vehicle/plant weed wash down protocols if required.	This Strategy
j)	Management of noxious weeds are to be undertaken in accordance with the <i>Biosecurity Act 2015</i> (repeals <i>Noxious Weeds Act 1993</i> ).	Section 2.2 Section 5 Section 6
k)	Equipment used for treating weed infestation will be cleaned prior to moving to a new area within the project site to minimise the likelihood of transferring any plant material and soil.	Section 6.2
l)	Soil stripped and stockpiled from areas containing known weed infestations are to be stored separately and are not to be moved to areas free of weeds.	Section 5.6



## **Annexure B: Weed Management Procedure**



### Noxious Weeds to be controlled

The table below shows noxious weeds over the project area outlined in the Stage 1 EIS – Biodiversity Assessment Report, and where they are likely to be located within the project area.













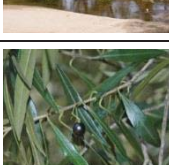
Photo	Details	Likely Location	Control Info
	Common Name: <b>Alligator Weed</b> Species Name: <i>Alternanthera philoxeroides</i> Class: 3	Anzac Creek, wetlands on western side of Georges River	Chemical control
	Common Name: <b>Bridal Creeper</b> Species Name: <i>Asparagus asparagoides</i> Class: 4	Banks of Georges River	Mechanical Removal or herbicide application by foliar spray
	Common Name: <b>Bitou Bush</b> Species Name: <i>Chrysanthemoides monilifera subsp. rotundata</i> Class: 3	Disturbed edges of bushland south of SIMTA site and east of SME Golf Course on MIC site	Mechanical removal of juvenile plants or herbicide application by cut and paint stump, foliar spray
	Common Name: <b>Pampas Grass</b> Species Name: <i>Cortaderia selloana</i> Class: 3	Disturbed area in the southern disturbed part of the Boot Land	Mechanical removal where possible is preferred. One chemical control option.
	Common Name: <b>Lantana</b> Species Name: <i>Lantana camara</i> Class: 4	Banks of Georges River	Mechanical Removal
	Common Name: <b>Broad-leaved Privet</b> Species Name: <i>Ligustrum lucidum</i> Class: 4	Western bank of Georges River	Mechanical removal or herbicide application – cut and paint stump, drill and inject
	Common Name: <b>Small-leaved Privet</b> Species Name: <i>Ligustrum sinense</i> Class: 4	Banks of Georges River	Mechanical removal or herbicide application – cut and paint stump, drill and inject

Photo	Details	Likely Location	Control Info
	Common Name: <b>Peruvian Primrose</b> Species Name: <i>Ludwigia peruviana</i> Class: 3	Anzac Creek, in wetland on western side of Georges River	Mechanical removal or herbicide application – foliar spray
	Common Name: <b>Prickly Pear</b> Species Name: <i>Opuntia sp.</i> Class: 4	Banks of Georges River	Mechanical removal
	Common Name: <b>Blackberry</b> Species Name: <i>Rubus fruticosus</i> agg. Spp. (includes <i>R. anglocandicans</i> ) Class: 4	Banks of Georges River, in disturbed bushland south of Anzac Creek	Mechanical removal or herbicide application – foliar spray
	Common Name: <b>Salvinia</b> Species Name: <i>Salvinia molesta</i> Class: 2	On Anzac Creek adjacent to existing culvert	Small infestations can be mechanically controlled. Herbicide application by foliar spraying for larger infestations.
	Common Name: <b>Willow</b> Species Name: <i>Salix alba</i> Class: 5	In wetland on western side of Georges River	Mechanical removal ensuring all of the root material is removed. Herbicide application either by foliar spray, cut stump or stem injection
	Common Name: <b>African Olive</b> Species Name: <i>Olea europaea subsp. cuspidate</i> Class: 4	Banks of Georges River	Mechanical removal or herbicide application – cut and paint stump, drill and inject, foliar spray, basal bark spray

## Annexures

## Annexure C: Herbicide Application Record Sheet

Date		Supervisor	
Operator Names			
Time Start		Time Finish	
Location		Chainage	Start Finish Up Down
Personal Protective Equipment (PPE) Required		Herbicide / Chemical Type  Brand	
Soil Conditions			
Weather Conditions	Overcast	Cloudy	Sunny
Wind Direction		Gusty	Yes / No NA
Wind Speed (Circle)	Medium	Low	Nil
Amount Used (mL of neat)		Concentration	Herbicide (mL) Water (Litre)
MSDS on site	Yes / No	SMART CARD	Yes / No
Comments			

**DO NOT SPRAY IN HIGH WINDS or LIKELIHOOD OF RAIN**

## **Attachment F: Nest Box Management Strategy**



# Nest Box Management Strategy

## Moorebank Precinct East Stage 1 – Rail Link

<b>Project number:</b>	N01031
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A	9 Mar 2016				Initial draft
B	6 Jun 2016				Updated to address SIMTA comments
C	15 Jul 2016				For SIMTA's second review
D	21 Dec 2016				Updated to address final CoAs and for consultation
E	6 Feb 2017				Updated for submission to DP&E
F/00	6 Apr 2017				Final DP&E Submission – Approved by DP&E
01	12 Dec 2017				6 monthly review
02	18 May 2018				Update hollow locations and nest box ratio
03	18 October 2018				Boundary update

Rev.	Date	Prepared by	Reviewed by	Approved by	Remarks
04	10 May 2019	[Redacted]	[Redacted]	[Redacted]	Updates from RfMA0022
Signature:		[Redacted]	[Redacted]	[Redacted]	

## Details of Revision Amendments and Authorship

### Document Control

The Project Director is responsible for ensuring that this strategy is reviewed and approved. The Environment Manager is responsible for updating this strategy to reflect changes to legal and other requirements, as required.

### Amendments

Any revisions or amendments must be approved by the Project Director before being distributed / implemented.

### Revision Details

Revision	Details
A	Initial draft for SIMTA review
B	Updated to address SIMTA comments
C	For SIMTA's second review
D	Updated to address final CoAs and for consultation
E	Updated for submission to DP&E
F/00	Final update for DP&E Submission Approved by DP&E
01	6 monthly review
02	Update hollow locations and nest box ratio
03	Boundary update
04	Updates from RfMA0022

### Document Authors, Reviewers and Qualifications

This document has been prepared and reviewed by appropriately qualified professionals as detailed below.

Author's Name	Qualifications
[REDACTED]	Bachelor of Science in Environmental Biology (Honours), University of Newcastle Upon Tyne, UK BioBanking, Biodiversity Certification and Major Projects Offsets Accredited Assessor Ecological Consultants Association of New South Wales – Practicing Member
[REDACTED]	Master of Environmental Engineering Management, University of Technology Sydney Bachelor of Engineering, University of Technology Sydney
[REDACTED]	Master of Science, Environmental Management, University of Cape Town
[REDACTED]	Master of Environmental Engineering Management, University of Technology Sydney Bachelor of Engineering (Civil & Environmental), University of Technology Sydney
[REDACTED]	Master of Environmental Science and Law, University of Sydney Bachelor of Science, University of Sydney

Author's Name	Qualifications
██████████	Bachelor of Business Administration majoring in Environmental Resource Management, Macquarie University Post Graduate Diploma in Safety Science, University of New South Wales Masters of Applied Science in Environmental Science, Sydney University
██████████	Bachelor of Engineering in Environmental Engineering (Honours), University of Western Australia



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# Nest Box Management Strategy

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## 1. Overview

### 1.1 Background

The purpose of this Nest Box Management Strategy (NBMS) is to compensate the loss of hollow-bearing trees in the Rail Link project. The scope of this NBMS has been determined based on the recommendations and conditions presented in a number of key Project documents, including:

- Services Agreement – Schedule 5 Principal's Project Requirements
- Conditions of Approval under SSD-6676 SIMTA Intermodal Terminal Facility – Stage 1 (NSW)
- Stage 1 EIS (including Framework CEMP)
- Stage 1 Response to Submissions Report (including Final Compilation of Mitigation Measures)
- Commonwealth Concept Plan EIS (including Framework CEMP)
- Other applicable legislative obligations

### 1.2 Project Scope

SIMTA's Moorebank Intermodal Terminal Development involves the construction and operation of the necessary infrastructure to support a container freight road volume of 250,000 twenty-foot equivalent units (TEU).

CPB Contractors' scope of work specifically applies to Stage 1 – RALP No. 1 which consists of a 2.8 kilometre rail line, along with its required infrastructure, to connect the Import-Export Terminal and Interstate Terminals to the Southern Sydney Freight Line (SSFL), and capable of accommodating trains up to 1,800m in length.

The SIMTA site is located in the Liverpool local government area. It is 27 kilometres south-west of the Sydney Central Business District (CBD), 26 kilometres west of Port Botany, 16 kilometres south of the Parramatta CBD, 0.6 kilometres from the M5 South-West Motorway, five kilometres east of the M5 South-West Motorway / Westlink M7 Motorway Interchange and connecting to the main north–south rail line via the Southern Sydney Freight Line.

The Moorebank Intermodal Terminal Development – RALP No. 1 is the first package of Stage 1 of the overall project and its construction will include:

- A northbound connection and a southbound connection to the SSFL
- Civil and earthworks, including remediation works and benching
- A Reinforced Earth Embankment (RE-Wall) through a section of the Glenfield Waste Services landfill site
- A bridge over the Georges River
- A culvert crossing over Anzac Creek
- Installation of new Moorebank Avenue overbridge
- Service relocation and protection
- Track work
- Signalling systems
- Security fencing

An indicative map of the Project is provided in Figure 1 below.

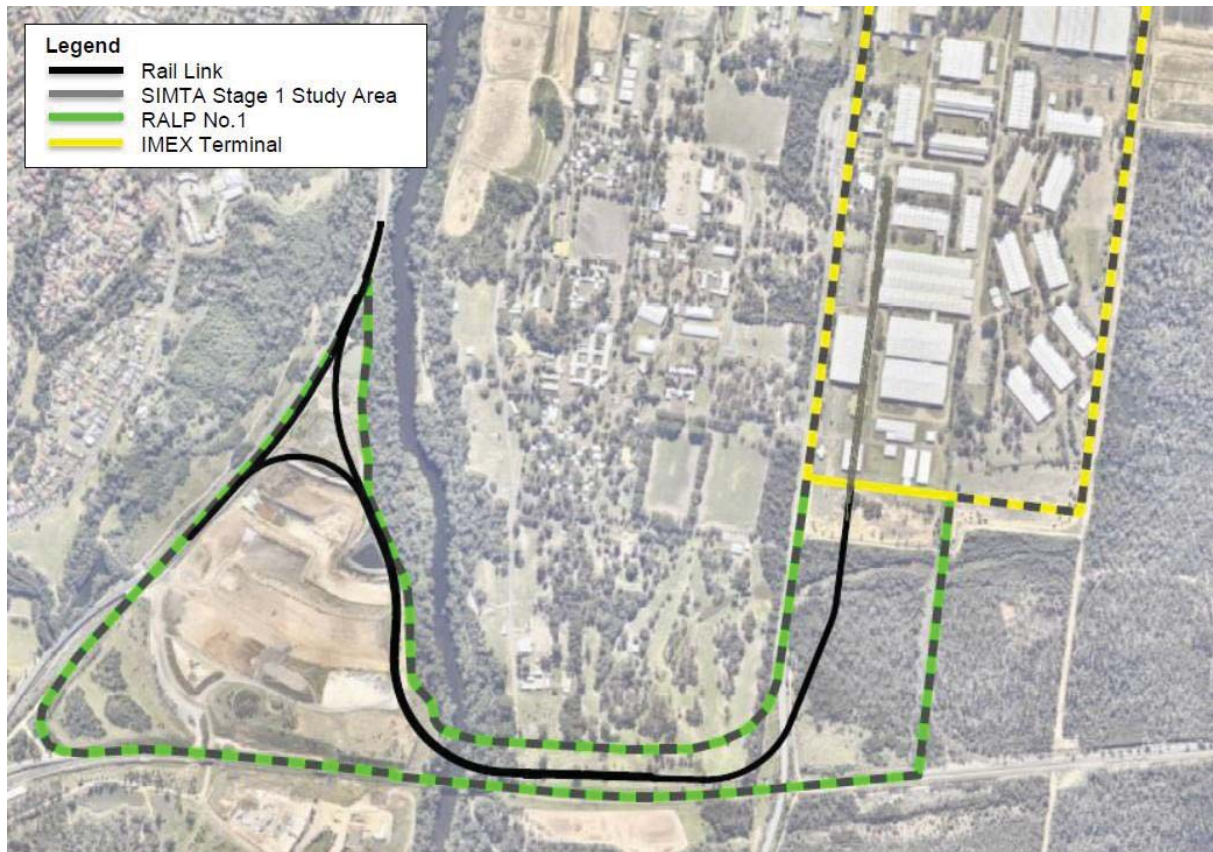


Figure 1: Indicative Project Map

### 1.3 Objectives

The objectives of this NBMS are to:

- Manage the impacts of the Rail Link Project on hollow-dependant fauna.
- Outline the potential threatened species that may utilise these resources.
- Detail the number, size and type of hollows being removed (based on the Project EIS data).
- Detail the number and type of nest boxes to be installed.
- Provide details of the location, maintenance and monitoring of nest boxes.

### 1.4 Interactions with Other Management Plans

This NBMS is an attachment to the Construction Flora and Fauna Management Plan, which is in turn a Sub Plan to the Construction Environmental Management Plan (CEMP). Figure 2 sets out interactions of this NBMS with the other environmental management documents that will be implemented on the Rail Link project.



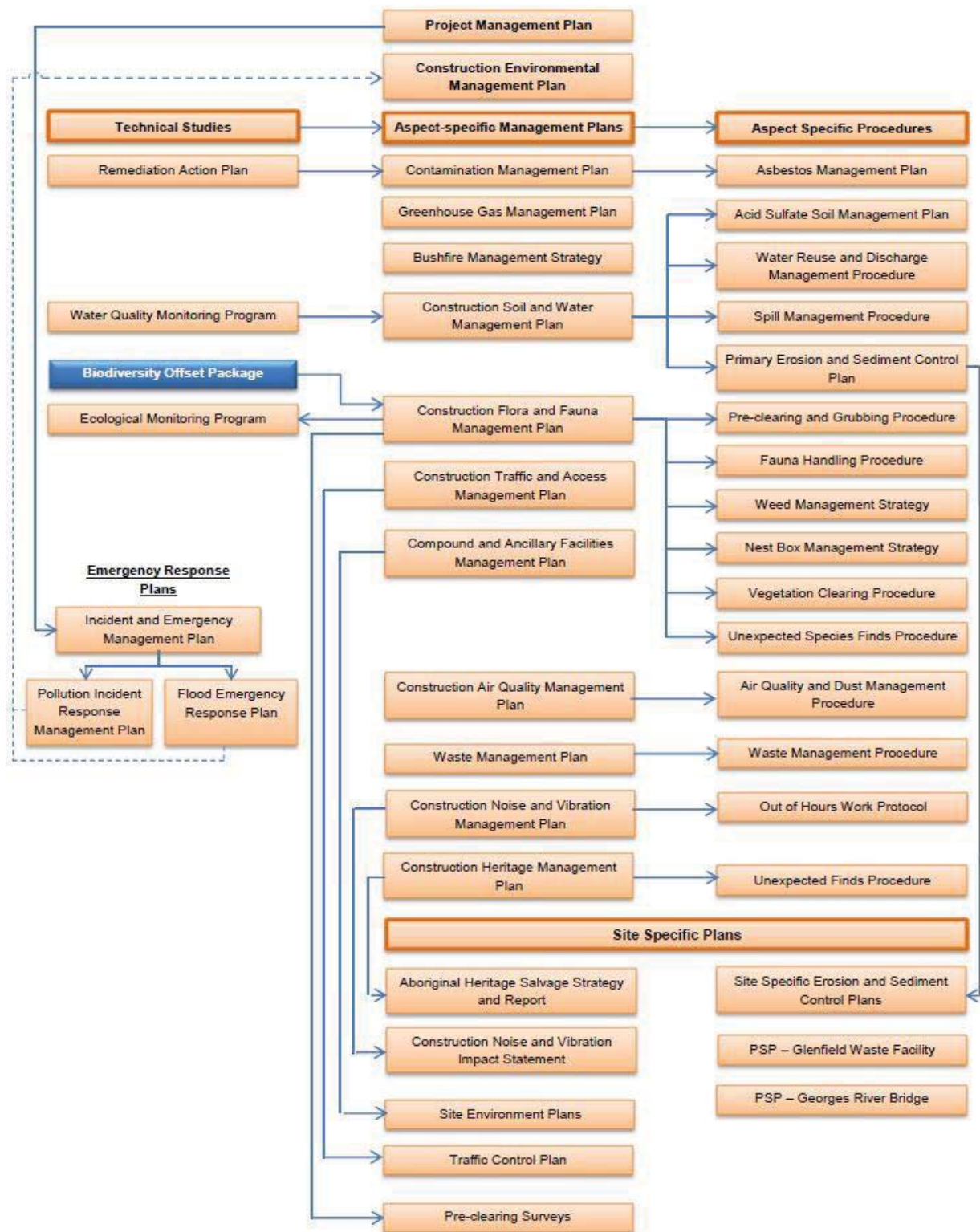


Figure 2: Environmental Documents Map

## 2. Legal and Other Requirements

### 2.1 Conditions of Project Environmental Approvals

The compliance of this document with the various environmental approval documents is demonstrated in Annexure A.

### 2.2 Relevant Legislation

The Project is designated State Significant Development (SSD) and has been assessed under Part 4 Division 4.1 of the EP&A Act. Key legislation relevant to the NBMS for the Project includes:

- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act)
- *Threatened Species and Conservation Act 1995* (TSC Act)

### 2.3 Guidelines

Reports, best practice guidelines and plans of relevance to the preparation of this NBMS include:

- Australian Government, 2015. Protected Matters Search Tool.
- Beyer & Goldingay, 2006. The value of nest boxes in the research and management of Australian hollow-using arboreal marsupials. *Wildlife Research* **33**: 161-174.
- BirdLife Australia (undated). Nest Boxes – Technical Information. Available at: [http://birdlife.org.au/images/uploads/education\\_sheets/INFO-Nestbox-technical.pdf](http://birdlife.org.au/images/uploads/education_sheets/INFO-Nestbox-technical.pdf).
- DECC, 2005. Recovering Bushland on the Cumberland Plain. Best practice guidelines for the management and restoration of bushland.
- DECCW, 2011. Cumberland Plain Recovery Plan.
- Department of Planning and Environment, 2015. SSD-14-6766 Indicative Conditions of Approval
- Gibbons and Lindenmayer, 2002. *Tree Hollows and Wildlife Conservation in Australia*. CSIRO Publishing, Collingwood, Australia.
- Gleeson and Gleeson, 2012. Reducing the Impacts of Development on Wildlife. CSIRO Publishing, Collingwood.
- Goldingay and Stevens, 2009. Use of artificial tree hollows by Australian birds and bats. *Wildlife Research* **36**: 81-97.
- Goldingay, 2009. Characteristics of tree hollows used by Australian birds and bats. *Wildlife Research* **36**: 394-409.
- OEH, 2015. Threatened Species Profile Database.
- TSSC, 2007. Loss of hollow-bearing trees – Key threatening process declaration. NSW Threatened Species Scientific Committee. Accessed online – <http://www.environment.nsw.gov.au/determinations/lossofhollowtreesktp.htm>.

### **3. Existing Environment**

The existing biodiversity characteristics of the Rail Link project are described in detail within the Stage 1 EIS and summarised within the CEMP. The sections below focus specifically on the hollow dependant fauna and hollow bearing trees associated with the Rail Link project.

#### **3.1 Threatened Species**

The Stage 1 EIS identified 28 threatened fauna species as having potential to occur within the RALP No.1 Project Area. Of these 28 species, 10 are known to utilise tree hollows of various sizes for refuge and breeding. A large number of species that are not listed under State and Commonwealth legislation will also utilise tree hollows for refuge and breeding purposes. Table 1 provides a summary of the threatened species that could potentially utilise tree hollows within the Rail Link project.

Table 1: Hollow Dependent Fauna with Potential Habitat within the Rail Link Project

Common Name	Scientific Name	TSC Act	EPBC Act	Habitat association based on vegetation communities			
<b>Birds</b>				<b>ME003</b>	<b>ME005</b>	<b>ME007</b>	<b>ME018</b>
Barking Owl	<i>Ninox connivens</i>	Vulnerable	-	Yes	Yes	No	Yes
Brown Treecreeper	<i>Climacteris picumnus subsp. victoriae</i>	Vulnerable	-	No	No	No	Yes
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	Vulnerable	-	Yes	Yes	No	Yes
Little Lorikeet	<i>Glossopsitta pusilla</i>	Vulnerable	-	Yes	Yes	No	Yes
<b>Arboreal mammals</b>							
Eastern Pygmy-possum	<i>Cercartatus nanus</i>	Vulnerable	-	Yes	Yes	No	Yes
Squirrel Glider	<i>Petaurus norfolkensis</i>	Vulnerable	-	Yes	Yes	No	Yes
<b>Microbats</b>							
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	Vulnerable	-	No	No	No	Yes
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	Vulnerable	-	Yes	Yes	Yes	Yes
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	Vulnerable	-	Yes	Yes	No	Yes
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	Vulnerable	-	Yes	Yes	Yes	Yes

ME003 - Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion

ME005 - Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion

ME007 - Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion

ME018 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion



### 3.2 Hollow-bearing Tree Inventory

Based on the results of the Stage 1 EIS field surveys presented within the Biodiversity Assessment Report (Hyder 2015), three hollow-bearing trees each with one hollow, occur within the Rail Link Project footprint (Figure 3). The hollow bearing tree inventory was compiled during diurnal surveys conducted across a total of seven days for the entire survey area. The Stage 1 EIS field surveys identified large numbers of hollow bearing trees, recorded outside of the Rail Link project, particularly on the western bank of the Georges River and will be retained.

The Rail Link commenced construction activities including related clearing and grubbing activities in July 2017. Respective pre-clearance surveys and clearing supervision has identified additional hollow bearing trees, as well as a separate targeted survey in areas of the project yet to be disturbed, namely the GWS premise and the Boot land. There are 21 hollow bearing trees for the Rail Link project, with a total of 35 hollow limbs (a number of hollows per tree were identified in some instances).

These hollows provide refuge and nesting habitat for woodland birds, arboreal mammals, hollow-roosting microbats, owls, cockatoos, reptiles, amphibians and invertebrate species. Threatened hollow-dependent fauna species that have the potential to occur within the Rail Link Project are outlined in Table 1. The location of known hollow bearing trees to be removed or have been removed from the Rail Link as at May 2018 is presented in Table 2 and illustrated in Figure 3.

Additional information regarding the hollow-bearing trees identified for removal and listed in Table 2 will be verified during prior to the installation of nest boxes so that appropriate next boxes are procured. The information to be confirmed includes tree species, size, height and size of hollow.

Table 2: Location of Hollow-bearing trees to be removed

HBT No.	Common Name	Scientific Name	Easting	Northing
1	Hard-leaved Scribbly Gum	<i>Eucalyptus sclerophylla</i>	308038.4	6240165.5
2	Unknown	Unknown	308041.7	6240133.4
3	Unknown	Unknown	307154.7	6239829.8
4	Unknown	Unknown	307033.9	6240928.4
5	Unknown	Unknown	307025.5	6240906.1
6	Unknown	Unknown	308040.4	6240129.7
7	Unknown	Unknown	308012.9	6240131.1
8	Unknown	Unknown	308019.9	6240055.6
9	Unknown	Unknown	307725.2	6239770.3
10	Parramatta Red Gum	<i>Eucalyptus parramatensis</i>	307704.9	6239803.7
11	Parramatta Red Gum	<i>Eucalyptus parramatensis</i>	307685.7	6239808.9
12	Parramatta Red Gum	<i>Eucalyptus parramatensis</i>	307661.8	6239805.7
13	Parramatta Red Gum	<i>Eucalyptus parramatensis</i>	307656.7	6239812.8
14	Narrow leaved Apple	<i>Angophora bakeri</i>	307623.7	6239791.5
15	Narrow leaved Apple	<i>Angophora bakeri</i>	307854.2	6239796.5
16	Narrow leaved Apple	<i>Angophora bakeri</i>	307851.3	6239797.7
17	Scribbly gum	<i>Eucalyptus schlerophylla</i>	307845.9	6239796.2
18	Unknown	Unknown	307218.4	6239790.2

HBT No.	Common Name	Scientific Name	Easting	Northing
19	Hard-leaved Scribbly gum	Eucalyptus schlerophylla	307791.7	6239851.9
20	Hard-leaved Scribbly gum	Eucalyptus schlerophylla	307517.3	6239798.1
21	Southern Mahogany	Eucalyptus botryoide saligna	307384.7	6239803.2



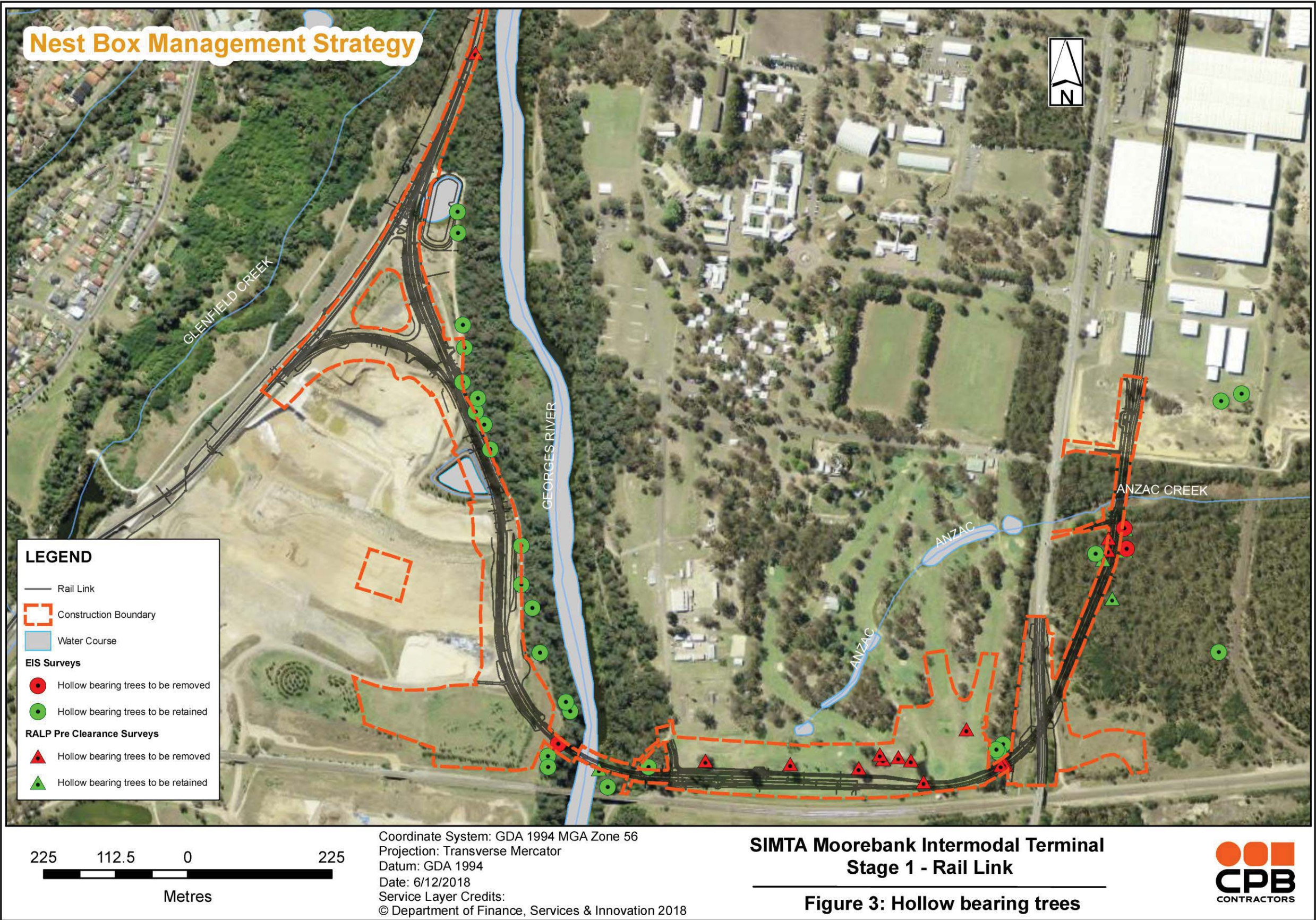


Figure 3: Existing Hollow-bearing Trees to be removed



## 4. Nest Box Installation

### 4.1 Nest Box Design and Construction

The nest box design requirements for nest boxes differ between species. The requirements for the species identified as having potential habitat within the Rail Link project (Table 1) are detailed in Table 3. Likewise, additional species requirements have been included for future information as more nest boxes may be required once the vegetation clearing is completed (to compensate for unidentified tree hollows that are removed).

Table 3: Design Characteristics for Nest Boxes

Fauna Group and Species	Nest Box Dimensions				
	Internal (mm)	Depth (mm)	Entrance (mm)	Height above ground (m)	
<b>Woodland Birds</b>					
Little Lorikeet	150x150	350	55	3–5	
Brown Treecreeper	90-150	100-400	50-80	5	
<b>Forest Owls</b>					
Barking Owl	250x300	500	100	4–6	
<b>Cockatoos</b>					
Gang-gang Cockatoo	300x400	1200	200	8–10	
<b>Arboreal Mammals</b>					
Eastern Pygmy-possum	150x150	300	30	3-6	
Squirrel Glider	150x250	300	45	3–6	
<b>Microbats</b>					
Eastern False Pipistrelle	20 (slot)	400	30 hole	3–5	
Eastern Freetail-bat	20 (slot)	400	30 hole	3–5	
Greater Broad-nosed Bat	20 (slot)	400	30 hole	3–5	
Yellow-bellied Sheath-tail-bat	20 (slot)	400	30 hole	3–5	



## 4.2 Competition Reduction Strategies

A key factor in the unsuccessful installation of nest boxes is their occupation by pest species. Some of these pest species can be put at competitive disadvantage by designing and installing the boxes appropriately. A summary of these is provided in Table 4 (based on Gleeson and Gleeson, 2012). These measures can be implemented during construction and installation or can be implemented if pest species are noted during monitoring activities.

Table 4: Measures to Minimise Pest Species Occupation

Pest Species	Appropriate Measure
Common Myna	An overhanging sheet of ply in front of the entrance (known as a Myna baffle) successfully deters Common Myna whilst allowing native species to use them.
Common Starling	Painting the interior of the box white deters Common Starling.
Ants and other insects	Talcum powder applied to the entrance, edges and inside of the nest boxes prevents use by ants.
	Petroleum jelly can be applied to the entrance or to the trunk of the tree to prevent ants from colonising or returning if already colonised.
Wasps	2cm roost spacing discourages wasp infestations in bat boxes.
European Honeybee	Lining the upper surfaces of nest box with a piece of carpet or petroleum jelly will prevent the attachment of the hive.

The nest box manufacturer will provide additional information on the competition reduction strategies that are integrated into their nest box design.

## 4.3 Nest Box Installation

The techniques applied for the installation of the nest box is key to their success, particularly when targeting certain species. Height, aspect, density and surrounding vegetation types must all be considered when sourcing a suitable location for installation. The proposed methodology is detailed below.

### 4.3.1 Nest Box Locations

The locations for installation of the nest boxes will broadly reflect the locations of the hollows to be removed. Nest boxes are being installed on the eastern bank of the Georges River instead of the western bank as there is more room on the eastern bank and the eastern bank is a proposed offset site for the SIMTA development, providing additional protection to the installed nest boxes. Where possible, nest boxes will be installed at least 50 metres from the boundary of vegetation clearance. This will reduce the disturbance to any fauna that take up residence in the nest boxes, by the Rail Link project. Figure 4 provides indicative locations for installation of nest boxes. These indicative locations have been selected based on the following criteria:

- Similarity of vegetation types when compared to the tree hollows to be removed.
- Suitability of the vegetation for the target species (see Table 1).
- Distance from the hollow-bearing tree to be removed.
- Distance from existing and future disturbances.

Other site selection criteria will need to be assessed at the time of installation, such as:

- Proximity of other hollow resources in the immediate vicinity.
- Similarity of vegetation structure immediately surrounding the hollow-bearing tree and nest box location.

The Project Ecologist or experienced nest box installer will therefore use their discretion to determine the final location of the nest box.

#### 4.3.2 Methodology

It is important that a tree of a suitable size, form and, in some cases, species be selected for the installation of a nest box. Various attachment mechanisms can be used to secure the box to the trunk. The Habisure System (TM Hollow Log Homes) uses a concertinaed wire and plastic guard to both protect the tree and allow for future growth. This system utilises existing forks in the trunk to support the load in a less invasive way than traditional affixing systems. This is the preferred method of fixing. Nest boxes will be installed:

- In eucalypts with a minimum diameter at breast height (DBH) of 30cm that contain no existing hollows.
- No less than three metres above the ground (and ideally no higher than 10 metres to allow for monitoring).
- With an aspect between north-west and east to minimise exposure.
- With approximately 50mm of dry organic material in the bottom for nesting.

#### 4.3.3 Reporting

The Project Ecologist or experienced nest box installer will make note of the following attributes during installation:

- Nest box number.
- Type of nest box.
- Location (using an un-corrected hand held GPS as a minimum).
- Approximate height above ground.
- Approximate aspect.
- Species of host tree.

These attributes will be compiled and submitted in the initial post installation monitoring report to be prepared and submitted to SIMTA within one month of installation (see Section 5.1 below).

#### 4.3.4 Timing

Nest boxes to replace the three hollow bearing trees identified in field surveys from the EIS will be installed up to one month prior to the commencement of clearing activities in order to provide refuge habitat for fauna that may be displaced during clearing. This will include the six nest boxes that are required to compensate the loss of the three tree hollows identified within the Rail Link project.





Figure 4: Potential Locations for Nest Box Installation



## 5. Nest Box Monitoring and Maintenance

Responsibility for completion of adequate monitoring and maintenance of nest boxes during the construction phase of the Rail Link project lies with the Environment Manager and would be delegated to the Project Ecologist to implement (see roles and responsibilities defined within the CFFMP).

### 5.1 Nest Box Monitoring

A monitoring program is proposed to determine the success of nest boxes, and identify any required maintenance activities. The monitoring program will be in addition to a post-installation round of monitoring, to be completed within one month of the final nest box installation. Note that the final installation may occur after the clearance of vegetation within the Rail Link project has been completed, as further nest boxes may be required if additional hollow bearing trees are identified.

The annual spring monitoring program will be conducted for the duration of CPB Contractors' construction period and will include a visual inspection of each nest box to collect the following information:

- Inspection details (such as date and time).
- Nest box number and location (for confirmation if the nest box number is illegible).
- Occupancy status (including species level identification where possible).
- Evidence of previous occupancy (such as scratches, debris, feathers or whitewash).
- Presence or evidence of previous feral species occupation.
- General condition of the nest box.
- Any recommended maintenance requirements.
- Any other notes such as changes to land use or reasons for low occupancy.

Installing the nest boxes below 10 metres in height will allow visual assessment from the ground using an inspection camera and extension pole.

Additional monitoring will be undertaken generally in accordance with Section 8.1 of the CFFMP.

### 5.2 Nest Box Maintenance

Nest box maintenance will be conducted on an as required basis, based on the outcomes and recommendations of the monitoring program. Common maintenance activities that may be required include:

- The need to remove pest species.
- Replacement of damaged nest boxes or components.
- Removal of excessive nesting material.
- Moving nest boxes that are not functioning correctly.
- Checking that boxes are draining adequately.

Any required maintenance activities should be noted within the annual report and classified as urgent or non-urgent activities. Urgent activities are ones that significantly hinder the ability of the nest box to deliver the objective of providing habitat for native species and should be actioned within 4 weeks of submission of the annual report. Non-urgent maintenance activities may be slight defects or temporary issues that do not require immediate action but that should be reassessed in the following monitoring event.

### 5.3 Annual Reporting

Following each annual spring monitoring event, a summary report will be prepared to describe the results of the monitoring program (as outlined in Section 5.1) and any corrective maintenance activities that were completed or are recommended. This report will be submitted to SIMTA for distribution amongst relevant stakeholders.



## Annexures

### Annexure A: Compliance Matrix

#### Conditions of Project Environmental Approvals

Conditions of project environmental approvals that specifically address the nest box management include:

#### Stage 1 Conditions of Approval

Table 5: Stage 1 Conditions of Approval

Stage 1 CoA Ref	Requirement	Where Addressed
E34 d)	a <b>Construction Flora and Fauna Management Plan</b> to detail how impacts on ecology (as detailed in the most recent mapping endorsed by OEH) will be minimised and managed. The Plan shall be developed by a suitably qualified and experienced ecologist and in consultation with the OEH, and shall include, but not necessarily be limited to:	CFFMP
(ii)	the identification of areas to be cleared and details of management measures to avoid residual habitat damage or loss and to minimise or eliminate time lags between the removal and subsequent replacement of habitat such as:	CFFMP
b)	clearing procedures (including nest box plan),	This Strategy

#### Stage 1 Final Compilation of Mitigation Measures

Table 6: Stage 1 Final Compilation of Mitigation Measures

Stage 1 FCMM Ref	Requirement	Where Addressed
8C	A nest box management strategy will be prepared prior to clearing of hollow bearing trees. The strategy will inform the installation of nest boxes in retained native vegetation in the riparian corridor of the Georges River and the woodland in the Southern Boot Land and the on-going monitoring and maintenance of nest boxes through the construction and operational phases.	This Strategy

#### Commonwealth Concept Plan Mitigation Measures

Table 7: Commonwealth Concept Plan Mitigation Measures

C'th Concept Plan MM Ref	Requirement	Where Addressed
7.4.1.3	<u>Mitigate</u>	
n)	Consider the installation of nest boxes in woodland vegetation in the rail corridor that may offer alternative nesting habitat to hollow dependent species recorded in the study area.	This Strategy



## **Attachment G: Aquatic Ecology Monitoring Plan**



# **Water Quality and Macroinvertebrate Monitoring Plan for Moorebank Precinct East Stage 1 RALP No. 1**

Prepared by AMBS Ecology & Heritage Pty Ltd  
for CPB Contractors Pty Limited

Report

December 2016

AMBS Reference: 15276



## Document Information

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# 1 Introduction

Sydney Intermodal Terminal Alliance's (SIMTA) Moorebank Precinct East (MPE) involves the construction and operation of the necessary infrastructure to support a container freight road volume of 250,000 twenty-foot equivalent units. CPB Contractors' scope of work specifically applies to MPE Stage 1 Rail Access Land Package (RALP) No. 1 which consists of a 2.8 km rail line, along with the required infrastructure, to connect the Import-Export Terminal and Interstate Terminals to the Southern Sydney Freight Line. It will be capable of accommodating trains up to 1,800 m in length.

The project was assessed in the SIMTA Intermodal Terminal Facility Environmental Impact Statement (EIS) (Hyder 2015) and subsequently a Construction Flora and Fauna Management Plan (CFFMP) (CPB 2016) has been developed. Within the CFFMP the Stage 1 Final Compilation of Mitigation Measures have been captured and this includes that *'water quality and macroinvertebrate monitoring would be undertaken up and downstream of works within the Georges River and Anzac Creek, pre, during and post construction, to determine impacts on aquatic communities as a result of the Project. The monitoring plan would be developed and implemented by an appropriately qualified aquatic ecologist'*.

Aspects of the project that have potential to impact upon aquatic ecology are the construction of:

- a bridge (approximately 11.3 m wide and 11 m high) over the Georges River supporting two rail tracks; and
- a culvert crossing over Anzac Creek composed of box culverts to a length of 15 m and supporting one rail track and a maintenance access footway.

The following monitoring plan has been developed to address the condition requiring assessment of impacts to water quality and macroinvertebrates as a result of the project. The plan provides timing, location, methods and reporting outcomes to monitor water quality and macroinvertebrates before, during and after the project construction.

## 2 Relevant Guidelines

The monitoring plan has been written to comply with the following relevant guidelines:

- Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update) (NSW DPI 2013);
- New South Wales Australian River Assessment System (AUSRIVAS) (Turak and Waddell 2004);
- ANZECC Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC 2000);
- AS/NZS 6557.1:1998 Water Quality-Sampling-Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples; and
- AS/NZS 5667.6:1998 Water Quality-Sampling-Guidance on sampling of rivers and streams.

## 3 Existing Environment

Aquatic Ecology surveys of the Georges River and Anzac Creek were undertaken as part of the project EIS (ALS 2011). Based on the results of the surveys, a description of the existing environmental values and aquatic communities at the two waterway survey locations are provided in this section.

### 3.1 Site Descriptions

#### 3.1.1 Georges River

The Georges River, at the survey site, is a lowland, slow flowing river close to the end of the catchment. Land use in the catchment upstream of the sampling site is a mixture of residential, light industrial and natural forest. The Georges River flows north where it transects the Rail Corridor and is considered to be a 6th order stream at this point. The river is freshwater here, until it flows over the Liverpool Weir approximately 3.5 km to the north.

The Georges River survey site was 100 m long and 40 to 60 m wide extending north from beneath the East Hills Railway Bridge. The river bank dropped rapidly to a depth of 1.2 m from beneath the East Hill Bridge before falling away at a steadier grade. Aquatic habitats present included soft substrate pool habitat, large woody debris and extensive macrophyte cover. Riparian vegetation was dominated by dense growth of *Lantana camara* (Lantana), with occasional tall *Eucalyptus* spp. Overhanging vegetation, fallen logs, mats of sticks, submerged *Elodea canadensis* and floating aquatic plants (*Azolla* sp., *Salvinia molesta*) were present in the littoral and edge habitats throughout the survey reach.

#### 3.1.2 Anzac Creek

Anzac Creek originates from the former School of Military Engineering site (MIC site) and extends north-east across the Rail Corridor just south of the SIMTA site. The creek flows north past the adjoining suburbs of Wattle Grove and Moorebank before draining into Lake Moore in Chipping Norton, which subsequently flows into the Georges River. It is considered to be a 3rd order stream.

The Anzac Creek survey site was located downstream of an old and currently unused rail crossing. The limited aquatic habitat included soft substrate pools and extensive macrophyte cover and there was no open or running water present at the site. The creek was obscured by dense growths of *Typha* sp. (Cumbungi) and *Salvinia molesta*. Water was mostly static and shallow (1 to 30 cm deep) with a small pool of approximately 1 m depth immediately downstream of the existing culvert tunnels running underneath the rail line. Riparian vegetation was dominated by *Melaleuca* sp., *Eucalyptus* spp., and other native shrub species.

### 3.2 Aquatic Fauna Habit

#### 3.2.1 Georges River

The Georges River is a major, permanently flowing river, and as such, was classified as Class 1 (Major Fish Habitat) in accordance with Fairfull and Witheridge (2003). It is mapped as 'Key Fish Habitat' on the Department of Primary Industries (DPI) Key Fish Habitat map for the Sydney Metropolitan area.

#### 3.2.2 Anzac Creek

Anzac Creek is a watercourse with intermittent flow supporting semi-permanent to permanent water in pools and, as such, was classified as Class 3 (Minimal Fish Habitat) in accordance with Fairfull and Witheridge (2003). The Anzac Creek AUSRIVAS sampling site fell into Band B, indicating that the macroinvertebrate community was 'significantly impaired'.

### 3.3 Macroinvertebrates

The macroinvertebrate community at both sampling sites was found to have at least some level of impairment and any further degradation of these sites is likely to influence the macroinvertebrate community on a local scale. In general, family diversity was low and many sensitive taxa were not



recorded. This result may be attributed to a current/existing 'potential' impact on water quality or habitat quality or both (ALS 2011).

### 3.3.1 Georges River

The survey area on the Georges River was isolated to a 100m stretch of the river. A large proportion of this reach was heavily vegetated with Lantana on the banks and dense submerged and floating aquatic plants including *Elodea canadensis*, *Azolla* sp. and *Salvinia molesta*. This could be considered to be poor quality habitat which lacks the diversity of micro-habitats to support a diverse and healthy macroinvertebrate community. A total of 18 macroinvertebrate families were recorded in the Georges River (ALS 2011). The Georges River site was rated in Band C by the AUSRIVAS model indicating that the macroinvertebrate community was 'severely impaired'.

### 3.3.2 Anzac Creek

Assessment of the macroinvertebrate community at the Anzac Creek site showed it to be more diverse and healthy than that of the Georges River site. Anzac Creek was limited to small static pools with dense coverings of macrophytes including *Typha* sp. (Cumbungi) and *Salvinia molesta* which limited the habitat available for fish sampling. Anzac Creek, at the location of the Hyder (2015) survey site, could be considered to represent an intermittent waterway or wetland that will only flow immediately following a substantial rain event. A total of 23 macroinvertebrate families were recorded in Anzac Creek (ALS 2011). Anzac Creek rated slightly better than the Georges River site with an AUSRIVAS Band B rating indicating the macroinvertebrate community was 'significantly impaired'.

## 4 Proposed Works

### 4.1 Georges River Bridge

The works associated with the construction of the Georges River Bridge will be contained within the 20 m corridor to be cleared for the Rail link. The construction of the bridge will be undertaken in approximately 10 to 12 months. Approximately 0.28 hectares of riparian habitat will be removed on the river banks for installation of the bridge and abutments.

A summary of the likely construction methodology for the Georges River railway bridge is provided below.

- Clearing and removal of riparian vegetation.
- Earthworks to construct a temporary access track to the Georges River, and establish area for construction activities.
- Construction of instream crane/piling rig platforms extending into the river from the eastern bank. Platforms will be constructed of clean compacted gravel and be temporary.
- Construction of bridge piers within the river bed and embankments. These will subsequently be extended as formed concrete columns. Piles will be bored into the river bed for the construction of the inner three bridge piers. Once bored, concrete will be poured into the steel tubing to form the bridge piers. These will subsequently be extended as formed concrete circular columns.
- Piles to be bored on dry ground for the remaining piers and abutments.
- Excavation to allow cast insitu concrete construction of the abutment headstocks, including wing walls at either end (eastern and western) of the bridge.
- Construction of headstock either formed up and cast in-situ or alternatively precast.
- Installation of Precast girders.
- Forming and reinforcement placement then concrete poured to create the bridge deck slab.

- Construction of rail systems onto the bridge deck.
- Rehabilitation of disturbed areas.

The Georges River will continue to flow throughout the construction of the bridge. Any platforms constructed in the Georges River will temporarily impede water movement in these areas, however, they will not dam river flow. Once construction has been completed normal river flow will be re-established.

## **4.2 Anzac Creek Culvert**

The works undertaken for the construction of the Anzac Creek culvert crossing will be contained within the 20 m corridor to be cleared for the Rail link. Approximately 0.03 hectares of instream vegetation (Coastal Freshwater Lagoon) and 0.05 hectares of riparian vegetation (Parramatta Red Gum Woodland) will be impacted for the installation of the culvert crossing/Rail link at Anzac Creek.

A summary of the likely construction methodology for the Anzac Creek culvert is provided below.

- Clearing and removal of vegetation at the Anzac creek crossing, within the 20 m clearing corridor.
- Earthworks to construct suitable areas for construction activities.
- Excavation of the Anzac Creek bed.
- Installation of base course material and concrete slab (cast in-situ) for the base of the culvert.
- Construction of culvert crossing including installation of culvert cells and wing walls.
- Excavation to facilitate construction of wing walls, which will be formed and then cast in-situ on either side of the culvert (or possibly precast units).
- Installation of rip rap (or similar) on either side of the culvert.
- Construction of rail infrastructure (permanent ways and rail systems).

Anzac Creek is generally a swampy area and therefore, subject to weather conditions, there is likely to be standing water at this location. Where reasonable and feasible, the works will be undertaken during dry weather, when there is no flow or water levels are very low. If water is present at the time of construction, dewatering of the creek will be required and a temporary diversion will be installed with the use of a dam structure such as a low flow earth mound or coffer dam, with water pumped (mechanically) around the construction area of culvert crossing. If the creek is dry at the time of construction, the site will be protected from water flow with a dam structure.

## **5 Potential Impacts of Construction**

The following description of potential impacts has been extracted from the ALS (2011) and Hyder (2015).

Bridge and culvert construction will require works within riparian and water course areas and could have a variety of potential impacts on the Georges River and Anzac Creek. These include:

- loss or reduction of fish passage;
- loss of biodiversity due to changes in hydrological function;
- lowering of water quality due to increased sediment loads;
- impacts on aquatic biodiversity due to changes in hydrological function and lowering of water quality during construction; and
- loss of riparian vegetation.

A variety of mitigation measures to address these potential impacts are outlined in the CFFMP (Section 7). The following aquatic monitoring plan has been designed to confirm the adequacy of these mitigation measures in protecting water quality and existing macroinvertebrate communities.

The EIS (ALS 2011) determined that while construction of a rail bridge may have localised impacts on the macroinvertebrate community at the Georges River it is unlikely to have any prolonged or widespread impacts and the community should recover from any disturbance in a short time following construction. According to the CFFMP potential impacts such as increased sedimentation or instream habitat alterations will be minimised to ensure the macroinvertebrate community does not degrade further.

At Anzac Creek, if development of the site alters the habitat, through direct habitat removal or indirect sources such as increased runoff and sedimentation, it is likely to impact the aquatic macroinvertebrate community (ALS 2011).

## 6 Monitoring Program

### 6.1 Design

The aquatic ecology monitoring program has been designed based on the values of the existing environment, methods of construction and potential impacts. The program will monitor habitat values, insitu water quality and macroinvertebrates to detect any impacts to the receiving environments from construction activities. The program is designed to align with sampling and analysis of the aquatic variables undertaken for the EIS aquatic assessment to enable comparisons of previous aquatic conditions (ALS 2011) with monitoring data.

### 6.2 Timing of Surveys

The project construction timing is approximately April 2017 to September 2018. The CFFMP specifies that monitoring be undertaken pre, during and post construction. The AUSRIVAS protocols (Turak et. al 2004) specify that macroinvertebrate surveys be undertaken in spring and autumn. To comply with the CFFMP requirements and AUSRIVAS protocols four monitoring surveys will be undertaken (Table 6.1). It is noted that the construction of the culvert at Anzac Creek will take 2-3 months which is less than the construction period for the bridge at the Georges River. As such pre, during and post construction monitoring at the Anzac Creek sites may be completed before the monitoring at the Georges River site (i.e. the September 2017 maybe the post construction monitoring event for Anzac Creek and sampling may not be required in March 2018).

**Table 6.1 Monitoring survey timing**

Season	Timing	Construction Timing
Autumn	Q1/Q2 2017	Pre-Construction
Spring	Q3/Q4 2017	During Construction
Autumn	Q1/Q2 2018	During Construction
Spring	Q3/Q4 2018	Post Construction

### 6.3 Location of Survey Sites

Monitoring surveys will be undertaken at two sites on each water course (one upstream and one downstream of the construction locations). The monitoring sites will be located within the vicinity

of the sites sampled for the EIS by ALS (2011). The Georges River EIS survey site was 100 m long and extended north from beneath the East Hills Railway Bridge. The Anzac Creek EIS survey site was downstream of an old and currently unused rail crossing. Figure 6.1 provides the location of the proposed monitoring sites.

## **6.4 Habitat Assessments**

The habitat assessments will be modified slightly from those undertaken for the EIS, to ensure compliance with AUSRIVAS protocols (Turak et. al 2004) and Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update) (NSW DPI 2013), however the data will still be comparable.

Aquatic habitat (bank and instream features) can impact the water quality of a stream, therefore at each monitoring site, the habitat along a 100m reach of river will be assessed. Habitat values will be recorded using the NSW Field Data Sheets (Appendix A). The habitat assessments will identify habitat variables such as, location (GPS coordinates); surrounding topography and landuse; water characteristics including, flow, level, depth, stream width and condition; habitat benthic substrate composition; riparian vegetation composition; and integrity and general habitat availability.

## **6.5 Water Quality**

Changes to the physical properties of water and sediments can have profound effects on aquatic plants and animals. Chemical and physical attributes affect water quality and include, for example, light penetration, temperature and salinity. Poor water quality occurs when levels of these attributes are outside their normal range. The ANZECC Guidelines (ANZECC/ARMCANZ 2000) provide a framework for assessing and monitoring the effects of changes in water quality.

At each survey site the water quality measurements and sampling will be taken prior to any other monitoring activity to ensure that the results are not compromised through disturbance to the benthic substrate. When recording water quality measurements, care will be taken not to disturb any potential habitats.

The insitu water quality readings will be taken using an electronic multi-parameter water quality meter to measure physicochemical parameters in the water column including; salinity (ppm), conductivity ( $\mu\text{S}/\text{cm}$ ), temperature ( $^{\circ}\text{C}$ ), dissolved oxygen (% saturation) and turbidity (NTU).

Measurements will be recorded in situ by lowering the logger meter by a cable down through the water column to pre-determined depths where measurements are recorded from the surface using the logger recorder.

## **6.6 Macroinvertebrate Surveys**

Macroinvertebrate surveys will be undertaken at the sites following standardised sampling methodologies that comply with the NSW AUSRIVAS Sampling and Processing Manual (Turak et. al 2004). The AUSRIVAS method involves sampling riffle and edge habitats with animals being live picked using forceps over a minimum 30-minute period. The resulting specimens will be placed into labelled sample jars containing 70% ethanol and transported to the laboratory for identification and enumeration.

### **6.6.1 Riffle Sampling**

The riffle habitat is defined as an area of broken water with a rapid current that has some cobble or boulder substratum. If the substrate within the riffle does not fit this description, then the available habitat would be described as marginal or unsuitable.



To sample, the substrate is disturbed by “kicking” or shuffling the streambed, with the kick net sitting on the substrate immediately downstream of the disturbance, allowing all disturbed matter to flow directly into the net. The sampler then continues this process of disturbing the streambed while moving backwards directly upstream. Turning over large rocks and rubbing them may be required to remove organisms.

Sampling of the riffle will continue until a 10 m section has been sampled. The aim of this technique is to obtain macroinvertebrates from a range of microhabitats within the riffle. This includes a range of substrates, flow velocities and depths, as well as shading/non shading etc.

If the net becomes full of debris (such as organic matter), which is inhibiting the nets efficiency, rinsing of the net into a bucket may be required before further sampling can continue.

#### *6.6.2 Edge Sampling*

An edge habitat generally has little to no flow, and is comprised of a variety of habitats, including bare edges, macrophyte beds, grasses, overhanging trees or branches, snags and logs amongst others.

The edge sample will be collected using the “sweep” method, which consists of a 10m sweep of the edge habitats in an upstream direction using a sweep net. This sampling will occur along the stream in an upstream direction. The “sweep” method will be reasonably short, fast and vigorous to minimise the loss of invertebrates. All habitats present at the collection site should be represented within the 10m sweep, hence the sweep is not a continuous sweep, but a representation of the habitats within the reach.

When sampling around vegetation, agitating the net can help to dislodge the invertebrates from the substrate. Along stream edges and logs the net sweeps are placed just above the substrate surface. Leaf packs are agitated enough to dislodge the animals without collecting large amounts of leaves.

#### *6.6.3 Specimen Sorting*

As specified in the NSW AUSRIVAS Sampling and Processing Manual (Turak et. al 2004), taxa will be collected in the following manner.

- For the first 5 minutes the active, abundant taxa should be collected whilst not being biased toward the larger and colourful ones.
- For the next 20 minutes’ effort should be concentrated to obtaining new taxa.
- If by 25 minutes no new taxa have been found, then the focus should shift to collecting more animals.
- If new taxa have been collected between 30 and 40 minutes, continue for an extra 10 minutes.
- If new taxa have been collected between 40 and 50 minutes, continue for an extra 10 minutes.
- Sorting time should occur for a maximum of 60 minutes.

The objective of using this method is to obtain a sample that contains as much taxa diversity as possible.

## **6.7 Analyses and Reporting**

Following each survey event, a brief summary report will be provided that will outline the following for each site.

- The results of the habitat assessments will be presented in the form of a site 'report card' including AUSRIVAS habitat rankings. The habitat rankings are provided in Appendix A (page 4) and include a visual assessment of disturbance relating to human activities at site and catchment scale.
- Water quality results analysed against the ANZECC 2000 Guidelines and comments regarding any values that fall outside the trigger values. Trigger values provide values for physical and chemical stressors in slightly disturbed ecosystems of south-east Australia. Trigger values are used to assess the risk of adverse effects due to nutrients, biodegradable organic matter and pH in various ecosystem types.
- Macroinvertebrate data will be analysed using SIGNAL2, EPT and univariate statistical methods to provide an assessment of the existing 'health' of the waterway based on the water quality and abundance and diversity of the macroinvertebrate families present. Monitoring for specific impacts relating to construction are best identified using SIGNAL2, EPT and univariate statistics which are able to identify localised changes in community structure.

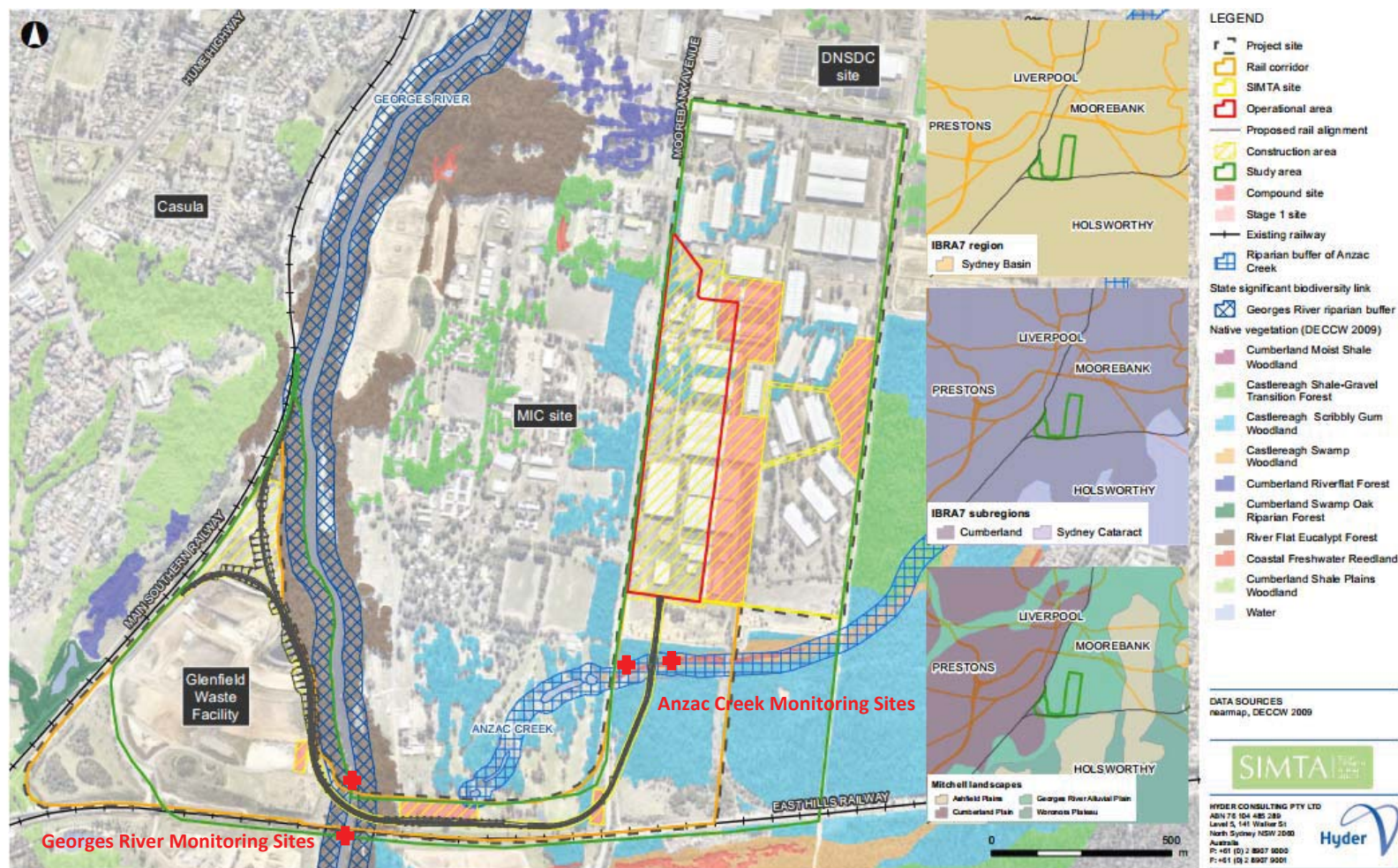
SIGNAL2 is a biotic grading index based on pollution sensitivity values assigned to aquatic macroinvertebrate families based on their tolerance to pollutants, such as sewage and nitrification. Each family in a sample is assigned a sensitivity grade between 1 (most tolerant) and 10 (most sensitive). Those families in a sample for which no grade can be assigned are excluded from the analysis. The SIGNAL2 index is calculated as the average grade number for all families present in the sample. The resulting index score can then be interpreted by comparison with reference and/or control sites.

The EPT taxa index refers to the proportional representation of key macroinvertebrate taxa belonging to the *Ephemeroptera*, *Plecoptera* and *Trichoptera* groups.

- Comment on whether construction activities are impacting on communities for that season.

Please note that AUSRIVAS modelling provides only a very broad analysis of community health and has already identified the target waterways as being severely or significantly impaired (ALS 2011). The current state of the waterways is unlikely to improve without major rehabilitation works being undertaken. As such the ability of AUSRIVAS modelling to detect change in the waterways over the proposed monitoring timeframe (i.e. 18 months) may be limited.

Following the completion of the post construction survey a final report combining the four seasons monitoring results will be developed. A full summary of the potential impacts of the project construction on the Georges River and Anzac Creek, based on the monitoring results, will be provided.



Map sourced from (Hyder 2015) SIMTA Stage 1 Biodiversity Assessment Report

**Figure 6.1** Approximate location of proposed monitoring site.

## **Bibliography**

- ALS Environmental (2011). Assessment of the Sydney Intermodal Transport Hub, Moorebank: Aquatic Ecology. report to Hyder Consulting Pty Ltd.
- ANZECC/ARMCANZ (2000). Australian and New Zealand guidelines for fresh and marine water quality. Volume 1, The guidelines Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand.
- CBP (2016). Construction Flora and Fauna Management Plan Moorebank Intermodal Terminal Development Stage 1 – RALP No. 1. Prepared by CBP Contractors Pty. Ltd.
- Fairfull, S. and Witheridge, G. (2003). Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries, Cronulla, 16 pp.
- Hyder (2015). SIMTA Intermodal Terminal Facility- Stage 1 Response to Submissions. Prepared by Hyder Consulting Pty Ltd.
- DPI (2013). Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update). NSW Department of Primary Industries.
- Turak E, Waddell N and Johnstone G (2004). New South Wales (NSW) Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual. NSW Department of Environment and Conservation.



## **Appendix A: AUSRIVAS NSW Field survey Sheets**

FNARH Field Datasheet

Site code: \_\_\_\_\_ Collection Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Location Name: \_\_\_\_\_

Sampling Team: Name

Organisation

Site Location:

AMG coordinates:

easting:

northing:

Confirmed:

easting:

northing:

Map Details:

Map Name:

Number:

Map Scale:

Map Zone:

Site Details:

(Office)

Elevation:

m

Slope:

m

Distance from Source:

m

Mean Annual Rainfall:

mm

Latitude:

Longitude:

Access Details:

Access Route:

Land Owner/Manager:

Name:

Address:

Phone:

Comments:

Fax:

Permission/key required:

granted verbally

in writing

notify prior to sampling:

key needed for access:

[ ]

[ ]

[ ]

[ ]

Office:

Entered on Computer [ ]

By:

date:

"

"

QC [ ]

By:

date:

FNARH Field Datasheet

Site code: \_\_\_\_\_ Collection Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

ATTRIBUTES OF THE SITE

<b>Topography</b>	Floodplain	Broad Valley	Steep Valley	Gorge
<b>Water Level</b>	No flow	Low	Moderate	High Flood
<b>Shading of river</b>	None	Low	Moderate	High
<b>Riparian Vegetation</b>				
Trees > 10m	Present	Absent		
Percentage Cover	Dominant Species			
Trees <10m	_____ %	_____		
Shrubs/ vines/ rushes	_____ %	_____		
Grasses/ herbs/ ferns	_____ %	_____		
<b>Stream Width</b>		<b>Percentage Cover in 100m reach</b>		
Minimum: _____ m		<b>Algae</b>	_____ %	
Maximum: _____ m		<b>Moss</b>	_____ %	
Mode: _____ m		<b>Macrophytes</b>	_____ %	

WATER QUALITY

Collection Time (24hr): \_\_\_\_:\_\_\_\_

**Water Quality Measurements**

Temperature \_\_\_\_\_ °C

Conductivity \_\_\_\_\_ µS/cm

Turbidity \_\_\_\_\_ NTU

Dissolved O<sub>2</sub> \_\_\_\_\_ mg/L

pH \_\_\_\_\_

Alkalinity \_\_\_\_\_

Nitrogen/phosphorus sample taken [ ]

BIRD'S EYE VIEW OF SITE

Land use

Examples: conservation area, native forest, recreation, forestry, rural-residential, grazing, cropping, industrial, commercial, residential.

(looking downstream)

Left bank: \_\_\_\_\_

Right bank: \_\_\_\_\_

Comments: \_\_\_\_\_

FNARH Field Datasheet

Site code: \_\_\_\_\_ Collection Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

ATTRIBUTES OF THE RIFFLE AND EDGE HABITATS

<b>RIFFLE</b>		Picked at site: Yes / No
Collector: _____	Sorter: _____	
<b>Description of natural substrate :</b>		<b>Depth:</b>
Bedrock	_____ %	Min: _____ m
Boulder (>200mm)	_____ %	Max: _____ m
Cobble (60-200mm)	_____ %	Mode: _____ m
Pebble (20-60mm)	_____ %	
Gravel (2-20mm)	_____ %	
Sand (0.02-2mm)	_____ %	<b>Percentage in habitat:</b>
Silt (0.002-0.02mm)	_____ %	Detritus Cover _____ %
Clay (<0.002mm)	_____ %	
<b>Total</b>	_____ %	

<b>EDGE/BACKWATER</b>		Picked at site: Yes / No
Collector: _____	Sorter: _____	
<b>Description of natural substrate :</b>		<b>Percentage in habitat:</b>
Bedrock	_____ %	Detritus Cover _____ %
Boulder (>200mm)	_____ %	Bank Overhang _____ %
Cobble (60-200mm)	_____ %	Trailing Bank Veg. _____ %
Pebble (20-60mm)	_____ %	
Gravel (2-20mm)	_____ %	Total Macrophytes _____ %
Sand (0.02-2mm)	_____ %	Submerged _____ %
Silt (0.002-0.02mm)	_____ %	Emergent _____ %
Clay (<0.002mm)	_____ %	Floating _____ %
<b>Total</b>	_____ %	

COMMENTS

Please comment on any exceptional circumstances that may affect sampling or sorting efficiency eg. Extreme weather conditions - raining, frost, low light, difficulties in getting an adequate sample etc. Any exceptional or unusual features of the edge/riffle habitat. Any abnormality with water quality data.

Sampling Conditions:	_____
Habitat Conditions:	_____
Water quality:	_____
Other:	_____
	_____
	_____
If sample/s not picked in the field	
RIFFLE where:	How long after sampling: _____
EDGE where:	How long after sampling: _____



## FNARH Field Datasheet

Site code: \_\_\_\_\_

Collection Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

**A Visual Assessment of Disturbance Related to Human Activities**

Below is an assessment of site disturbance broken down into a number of categories. Please make comments on any visual observations that indicate human disturbance for each category and give a ranking. Examples of relevant observations are listed below each category. However, this list is by no means complete and should be used as a guide only. In making your judgement, take into account the type of stream and geographic region you are sampling in. Once this is complete add up all the category rankings to give a grade, out of ten, for the site as a whole.

In the field please record any observations relating to catchment disturbance. A ranking will be assigned back at the office.

<b>Ranking</b>	0	= no evidence of disturbance	3	= high disturbance
	1	= little disturbance	4	= extreme disturbance
	2	= moderate disturbance		

**Site Assessment**

<b>Water Quality</b>	Ranking	0	1	2	3	4	<input type="text"/>
----------------------	---------	---	---	---	---	---	----------------------

Examples: odour, water clarity, disruption of the natural hydrology, presence of foam from detergents, oil.

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

<b>Instream</b>	Ranking	0	1	2	3	4	<input type="text"/>
-----------------	---------	---	---	---	---	---	----------------------

Examples include: change in substrate eg. rock piles or sedimentation from road construction or other development pipes, rubbish, filamentous algae, alien fish species, invasion by exotic aquatic plants.

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

<b>Riparian Zone</b>	Ranking	0	1	2	3	4	<input type="text"/>
----------------------	---------	---	---	---	---	---	----------------------

Examples include: devegetation, exotic plant invasion bank degradation, point sources.

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Catchment Assessment**

Examples include: mine, STP, tip, dam, industry, logging, agriculture, clearing, salinity, grazing, urban development.

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

<b>Office Work</b>	Ranking	0	1	2	3	4	<input type="text"/>
--------------------	---------	---	---	---	---	---	----------------------

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## **Attachment H: Form for Permit to Clear Land or Vegetation**

# Permit to Clear Land or Vegetation

## SECTION 1 – REQUEST DETAILS

Site			Date	
Area Supervisor			Position	
Purpose of Ground Disturbance				
Total disturbance area (ha)			Date disturbance to commence	
Estimated Topsoil Depth (mm)			Date disturbance to be completed	
Estimated Topsoil volume (m <sup>3</sup> )			Machinery to be used	
Map (attached)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Comments:	
Has a risk Work Pack been completed for this task?	<input type="checkbox"/> Yes.	<input type="checkbox"/> No	Comments:	
GPS Coordinates of planned area to be disturbed				

Once the above is completed please forward to Environmental Representative/Advisor for processing

<b>OFFICE USE ONLY:</b>	Permit # _____
	Status _____
	Received by Environmental Representative/Advisor for Review/Approval: DD/MM/YY
	Submitted to Client for Review/Approval (if required): DD/MM/YY
	Followed up: DD/MM/YY
	Approval Received: DD/MM/YY

## SECTION 2 – PERMIT CONDITIONS

Condition		Area Supervisor to Complete		
		Date	Initial	Comments
2.0	No clearing to be undertaken until this Permit to Clear Land or Vegetation is received, signed, completed and all permit conditions understood and in place			
2.1	Disturbance area delineated with flagging tape			
2.2	Pre Clearing Inspection Checklist completed			
2.3	Pre Clearing Surveys by Ecologist has been carried out and relevant hold points on project ITP released			

2.4	Exclusion areas identified and boundaries marked and clearly visible.			
2.5	Appropriate Cultural Heritage permit/s are in place where applicable (check with Client if required)			
2.6	Ground engaging equipment confirmed as weed free (use Tool: Plant and Equipment Cleandown Declaration).			
2.7	Operators working in the area have been shown the clearing limits by Area Supervisor. Personnel undertaking works are appropriately trained and aware of environmental risks.			
2.8	Large, woody vegetation to be stockpiled separately in approved location or used for Erosion Sediment control or fauna habitat.			
2.9	Disturbance area inspected for fauna and habitat trees and relocated, where applicable			
2.10	Topsoil to be removed to a ____ mm depth Subsoil to be removed to a ____ mm depth			
2.11	Topsoil to be stockpiled in approved areas. Subsoil to be stockpiled separately in approved areas			
2.12	Topsoil and subsoil stockpiles are to be less than 2m high			
2.13	Topsoil stockpiles to be signposted and mapped.			
2.14	Area to be surveyed post disturbance to ensure no unauthorised disturbance.			
2.15	Post Clearing Inspection Checklist to be completed at completion of clearing			
2.16	<p>The clearing of the following threatened flora species shall be recorded to ensure total numbers cleared are below maximum limits:</p> <ul style="list-style-type: none"> <li>• <i>Persoonia nutans</i> (17 maximum)</li> <li>• <i>Grevillea parviflora</i> (634 maximum)</li> </ul> <p>If the cumulative total approaches the respective approved limit of the above mentioned flora then clearing is to cease and additional approval must be sought.</p>			
2.17	Biodiversity Offset package (Condition 23) has been satisfied/approved and implemented; required for disturbance between the southern boundary of the terminal site and the eastern side of Moorebank Avenue Bridge (Southern Boot land).			
2.18	The site progressive erosion and sediment control plan (PESCP) has been read and signed by the site supervisor, and all controls to be implemented in accordance with the PESCP.			
2.20	High visibility plastic fencing has been installed to clearly define the limits of works within the Southern Boot Land, riparian corridor of the Georges River, and within 10 metres of previously recorded threatened species location(s).			
2.21	All 6 nest boxes installed by Ecologist one month prior to clearing and any additional boxes installed within one month following completion of clearing activities.			
2.22	The crew and Site Supervisor undertaking clearing works have read and signed onto the relevant project Work Pack for Clearing and Grubbing Activities.			



2.23	<p>The crew and Site Supervisor undertaking clearing works have been toolboxed and understand the following clearing methodology to be implemented during the works:</p> <ul style="list-style-type: none"> <li>Vegetation clearing will avoid periods when rain is forecast and will not be undertaken following significant rain that causes overland flow events</li> <li>Undertake a two-stage approach to clearing: <ul style="list-style-type: none"> <li>Remove non-hollow bearing trees at least 48 hours before habitat trees are removed</li> <li>The Project ecologist will complete a visual assessment of the hollow bearing tree for signs of resident fauna</li> <li>Hollow bearing trees are to be knocked with an excavator bucket or other machinery to encourage fauna to evacuate the tree immediately prior to felling</li> <li>Ecologist will complete another visual assessment and once satisfied, the tree will be felled (either by chainsaw or excavator) ensuring that it does not fall outside of the vegetation clearance boundary. All practical measures will be taken to ensure that the tree falls as slowly as possible</li> <li>Felled trees must be left for a short period of time on the ground to give any fauna trapped in the trees an opportunity to escape before further processing of the trees</li> <li>Felled hollow bearing trees must be inspected by an ecologist as soon as possible (not longer than 2 hours after felling).</li> </ul> </li> <li>Fauna encountered during the clearing activity will be managed in accordance with the relevant flow chart in the FFMP.</li> </ul>			
2.24	Soil excavated from the Anzac Creek corridor must be disposed of in accordance with the guidelines in the Alligator Weed Control Manual (DPI 2007), as it will likely contain fragments of Alligator Weed.			
2.25	Weed to be managed in accordance with the project Weed Management strategy			
<b>SECTION 3 – PERMIT ISSUE (Completed by Permit Issuer)</b>				
I confirm the work area is controlled and authorise work to proceed in strict accordance with the conditions stated in this Work Permit and associated Work Pack and Site Environmental Plans.				
Permit Issuer		Signature		Date & Time
<b>SECTION 4 – PERMIT ACCEPTANCE (Completed by Permit Holder)</b>				
I confirm and accept the conditions stated in this Work Permit and associated work activity documents. I will ensure strict adherence to these conditions and all persons under my control will be advised accordingly.				
Permit Holder		Signature		Date & Time
<b>SECTION 5 – SIGN OFF</b>				
Site Environmental Representative OR Project Manager Sign Off				
Name		Signature		Date
Client Representative Sign Off (if needed)				

<b>Name</b>		<b>Signature</b>		<b>Date</b>	
<b>Area Supervisor Sign Off</b>					
<b>Name</b>		<b>Signature</b>		<b>Date</b>	
<b>Equipment Operators Involved in Clearing</b>					
- have been advised of Land Disturbance Permit conditions and understand requirements/clearing boundary					
<b>Name</b>		<b>Signature</b>		<b>Date</b>	
<b>Name</b>		<b>Signature</b>		<b>Date</b>	
<b>Name</b>		<b>Signature</b>		<b>Date</b>	
<b>Name</b>		<b>Signature</b>		<b>Date</b>	
<b>Name</b>		<b>Signature</b>		<b>Date</b>	
<b>Name</b>		<b>Signature</b>		<b>Date</b>	
<b>Name</b>		<b>Signature</b>		<b>Date</b>	
<b>Name</b>		<b>Signature</b>		<b>Date</b>	

## **Attachment I: MPE Stage 1 Rail Link – Threatened Flora Species**

**Date** 23/03/2017  
**To** [REDACTED]  
**From** [REDACTED]  
**Copy to** [REDACTED]  
**Subject** MPE Stage 1 Rail link - Threatened flora species

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### Purpose

This memo has been prepared to inform the Construction Flora and Fauna Management Plan (CFFMP) for MPE Stage 1 – Rail Access Land Package (RALP) No. 1, to provide the relevant details and background information for reference in the CFFMP to address condition E34d)(i) which requires the CFFMP to include “plans for impacted and adjoining areas showing ..... locations where threatened species, populations or ecological communities have been recorded; including pre-clearing surveys to confirm the location of threatened flora and fauna species and associated habitat features;”

It is considered that the areas that are “impacted and adjoining” the MPE Stage 1 Rail link include the area within the MPE Stage 1 Rail link footprint plus a 100 metre buffer, which provides a conservative estimate of the extent of potential indirect impacts.

The memo also provides details of the additional ecology surveys undertaken of the Railcorp Land to address the Final Compilation of Mitigation Measures 8A and to respond to OEH review comments on the CPB CFFMP for the Rail Access Link raised during consultation with OEH.

### Background

Biodiversity surveys were conducted on the Bootland between 2011 and 2017. Surveys conducted between 2011 and 2015 are documented in Hyder Consulting (2015). Targeted threatened flora surveys that covered the land that is impacted by or adjoining the MPE Stage 1 Rail Link were undertaken in the following periods:

- July 2012: threatened flora species searches in the Boot land targeting *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora* – surveys conducted as part of investigations for MPE Concept Plan Environmental Impact Statement (EIS).
- November 2014: threatened flora species searches in the Boot land targeting *Persoonia nutans*, *Grevillea parviflora* subsp. *parviflora*, *Acacia bynoeana* and *Hibbertia* sp. Bankstown – surveys conducted as part of investigations for MPE Stage 1 EIS.
- January 2015: threatened flora species searches in the Boot land targeting *Persoonia nutans* – surveys conducted as part of investigations for MPE Stage 1 EIS.
- October-November 2016: threatened flora species searches in the Boot land targeting *Hibbertia* spp. – surveys conducted to inform biodiversity offset calculations
- February 2017: threatened flora species searches on land that is impacted by or adjoining the MPE Stage 1 Rail Link targeting *Hibbertia* spp – surveys conducted to inform the CFFMP and satisfy mitigation measures.

### Methodology

The targeted threatened flora surveys used similar survey methodologies. The methods used in each sampling period are summarised below:



- July 2012: the areas of habitat north of Anzac Creek were intensively searched by two ecologists walking in east-west aligned transects spaced no more than two metres apart. GPS waypoints were recorded at points where the species occurred. Areas of habitat south of Anzac Creek, were surveyed using north-south transects four metres wide, spaced 10 metres apart. GPS waypoints were recorded at points where the species occurred and the number of plants/stems within each four metre x four metre quadrat was recorded. These surveys extended into the area east of the existing Defence rail spur that intersects the Boot land.
- November 2014: the areas of habitat south of Anzac Creek were surveyed using north-south transects four metres wide, spaced 10 metres apart. GPS waypoints were recorded at points where species occurred and the number of plants/stems within each four metre x four metre quadrat was recorded.
- January 2015: threatened flora species searches in the area north of Anzac Creek and south of the MPE Site. The area was intensively searched for *Persoonia nutans* by two ecologists walking in east-west aligned transects spaced no more than two metres apart. GPS waypoints were recorded at points where the species occurred.
- October-November 2016: the vegetation in the Boot land south of the MPE site and Anzac Creek was surveyed using north-south transects four metres wide, spaced 10 metres apart. GPS waypoints were recorded at points where the species occurred and the number of plants within each approximately four metre x four metre quadrat was recorded.
- February 2017: targeted searches using parallel walking transects were conducted in the areas of Castlereagh Scribbly Gum Woodland and Castlereagh Swamp Woodland to the north of Anzac Creek and in the Railcorp land that is impacted by or adjoining the MPE Stage 1 Rail Link. Although these surveys were conducted outside of the known flowering season for *Hibbertia puberula* subsp. *puberula*, the species was observed to be in a late stage of fruiting and its identification could be confirmed in the field.

This methodology used is in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016). The areas surveyed during each sampling period are shown on Figure 1 and the location of the threatened species identified as a result of these surveys is included in Figure 2.

## Results

Threatened flora species identified during targeted surveys are as follows:

- July 2012: *Persoonia nutans* was recorded in the Castlereagh Scribbly Gum Woodland north of Anzac Creek. *Grevillea parviflora* subsp. *parviflora* was recorded in the large patch of Castlereagh Scribbly Gum Woodland south of Anzac Creek in the Rail Corridor. *Grevillea parviflora* subsp. *parviflora* was recorded on both sides of the existing Defence rail spur that intersects the Boot land.
- November 2014: Repeated transect surveys to the west of the existing rail spur found a higher stem density of *Grevillea parviflora* subsp. *parviflora* than previously recorded. One plant of *Persoonia nutans* was recorded in the habitat to the south of Anzac Creek.
- January 2015: *Persoonia nutans* was recorded in Castlereagh Scribbly Gum Woodland north of Anzac Creek, on both sides of the existing Defence rail spur. Two distinct sub-populations were identified, separated by an approximately 170 metre gap.
- October-November 2016: Four threatened species were identified in the area: *Acacia bynoeana*, *Hibbertia fumana*, *Hibbertia puberula* subsp. *puberula* and *Persoonia nutans*. *Hibbertia puberula* subsp. *puberula* was recorded across the north and centre of the survey area, where it was present in large numbers. *Hibbertia fumana* and *Acacia bynoeana* were recorded in the south-east of the survey area, in a long transitional zone between Castlereagh Ironbark Forest and Castlereagh Scribbly Gum Woodland. *Persoonia nutans* was recorded in scattered locations in the centre and west of the survey area. Identification of the species *Hibbertia fumana* and *Hibbertia puberula* subsp. *puberula* was confirmed by the National Herbarium of NSW.

- February 2017: Two threatened species were identified in the area surveyed: *Hibbertia puberula* subsp. *puberula* was recorded north of Anzac Creek and along the northern boundary of the Railcorp land, and *Grevillea parviflora* subsp. *parviflora* was recorded in the north-east of the Railcorp land.

Of the threatened species recorded in the above surveys, three threatened species are located within areas that are impacted by or adjoining the MPE Stage 1 Rail link: *Persoonia nutans*, *Grevillea parviflora* subsp. *parviflora* and *Hibbertia puberula* subsp. *puberula*. The plants that will be impacted form part of larger populations of each species identified on the Boot land, most of which occur to the east of the MPE Stage 1 Rail link.

Two of the threatened species, *Acacia bynoeana* and *Hibbertia fumana*, were recorded at considerable distance (130 to 180 metres) from the MPE Stage 1 Rail link, and are unlikely to be impacted by it. As such, they are not considered to fall within the “impacted and adjoining areas” of land and therefore the CFFMP is not directly applicable to these species.

The threatened species recorded and their proximity to the MPE Stage 1 Rail Link are presented in Tables 1 and 2; Table 1 lists the impacts to threatened flora species as assessed in the BAR supporting the EIS and Response to Submissions (RtS) for the MPE Stage 1 development, and Table 2 lists the updated impacts following surveys to satisfy requirements for biodiversity offsets, conditions of approval and mitigation measures. The locations of threatened flora species in relation to the MPE Stage 1 Rail Link are shown in Figure 2.

Table 1. Threatened flora species impacts as assessed for the EIS/RtS

Species	TSC Act status	EPBC Act status	Total number of plants recorded	Total number of plants within MPE Stage 1 footprint	Distance between MPE Stage 1 footprint and closest record
<i>Acacia bynoeana</i>	Endangered	Vulnerable	0	0	0
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> <sup>1</sup>	Vulnerable	Vulnerable	Estimated 7100 stems	Approximately 20 stems	n/a (within impacted and adjoining areas of land)
<i>Hibbertia fumana</i>	Not listed at time of EIS/RtS preparation	Not listed	0	0	n/a
<i>Hibbertia puberula</i> subsp. <i>puberula</i>	Endangered	Not listed	0	0	n/a
<i>Persoonia nutans</i> <sup>1</sup>	Endangered	Endangered	126	11	n/a (within impacted and adjoining areas of land)

Table 2. Threatened flora species impacts as updated from surveys to satisfy requirements for biodiversity offsets, conditions of approval and mitigation measures

Species	TSC Act status	EPBC Act status	Total number of plants recorded	Total number of plants within MPE Stage 1 footprint	Distance between MPE Stage 1 footprint and closest record
<i>Acacia bynoeana</i>	Endangered	Vulnerable	33	0	140 metres (outside of impacted or adjoining areas of land)
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> <sup>1</sup>	Vulnerable	Vulnerable	Estimated 7100 stems	Approximately 20 stems	n/a (within impacted and adjoining areas of land)
<i>Hibbertia fumana</i>	Critically Endangered (Provisional listing)	Not listed	370	0	180 metres (outside of impacted or adjoining areas of land)
<i>Hibbertia puberula</i> subsp. <i>puberula</i>	Endangered	Not listed	1168	45	n/a (within impacted and adjoining areas of land)
<i>Persoonia nutans</i> <sup>1</sup>	Endangered	Endangered	132	11	n/a (within impacted and adjoining areas of land)

### Threatened flora species habitat in the Railcorp land

The areas of native vegetation on the Railcorp land comprise degraded regrowth with scattered canopy trees and dense stands of *Acacia* spp. and *Kunzea ambigua* (Tick Bush). The ground layer within areas of native shrub and tree cover was dominated by invasive exotic grass species, with some patchy cover of native grass and herb species in patches. Most of the Railcorp site was cleared in the 1980s in association with construction of the existing Defence rail spur and the East Hills Rail line, as shown in the aerial photograph at Figure 3. The vegetation is consistent with regeneration from historical clearing and disturbance, with a substantial exotic component, high density of colonising native shrubs and a lack of older trees or ground timber.

The vegetation in the north of the site is disturbed regrowth Castlereagh Scribbly Gum Woodland, with cleared and highly disturbed exotic-dominated vegetation in the south-west. Although degraded, the vegetation would still fall within the definition of the threatened ecological community Castlereagh Scribbly Gum Woodland in the Sydney Basin bioregion under the TSC Act and Castlereagh Scribbly Gum and Agnes Banks Woodland of the Sydney Basin Bioregion under the EPBC Act.

The majority of the Railcorp land represents poor habitat for threatened flora species, with a disturbed ground layer, presumably as a result of historical clearing. The only records of threatened species that were located in less disturbed areas of vegetation along the northern boundary and in the east. Two individuals of *Hibbertia puberula* subsp. *puberula* were recorded adjoining the fence between the Railcorp site and the Boot land, over 50 metres east of the Stage 1 footprint. Several stands of *Grevillea parviflora* subsp. *parviflora* were identified further to the south-east, with over 50 stems observed across four locations.

#### **Management of threatened flora species occurring within and adjacent to the MPE Stage 1 footprint**

The Threatened Flora Species Management Plan (Appendix A of Hyder Consulting 2015) prepared to support the EIS and RtS for the MPE Stage 1 development includes measures for management of threatened plant species in the MPE Stage 1 construction footprint. These measures were developed for management of *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora*, but are all considered appropriate for management of *Hibbertia puberula* subsp. *puberula*.

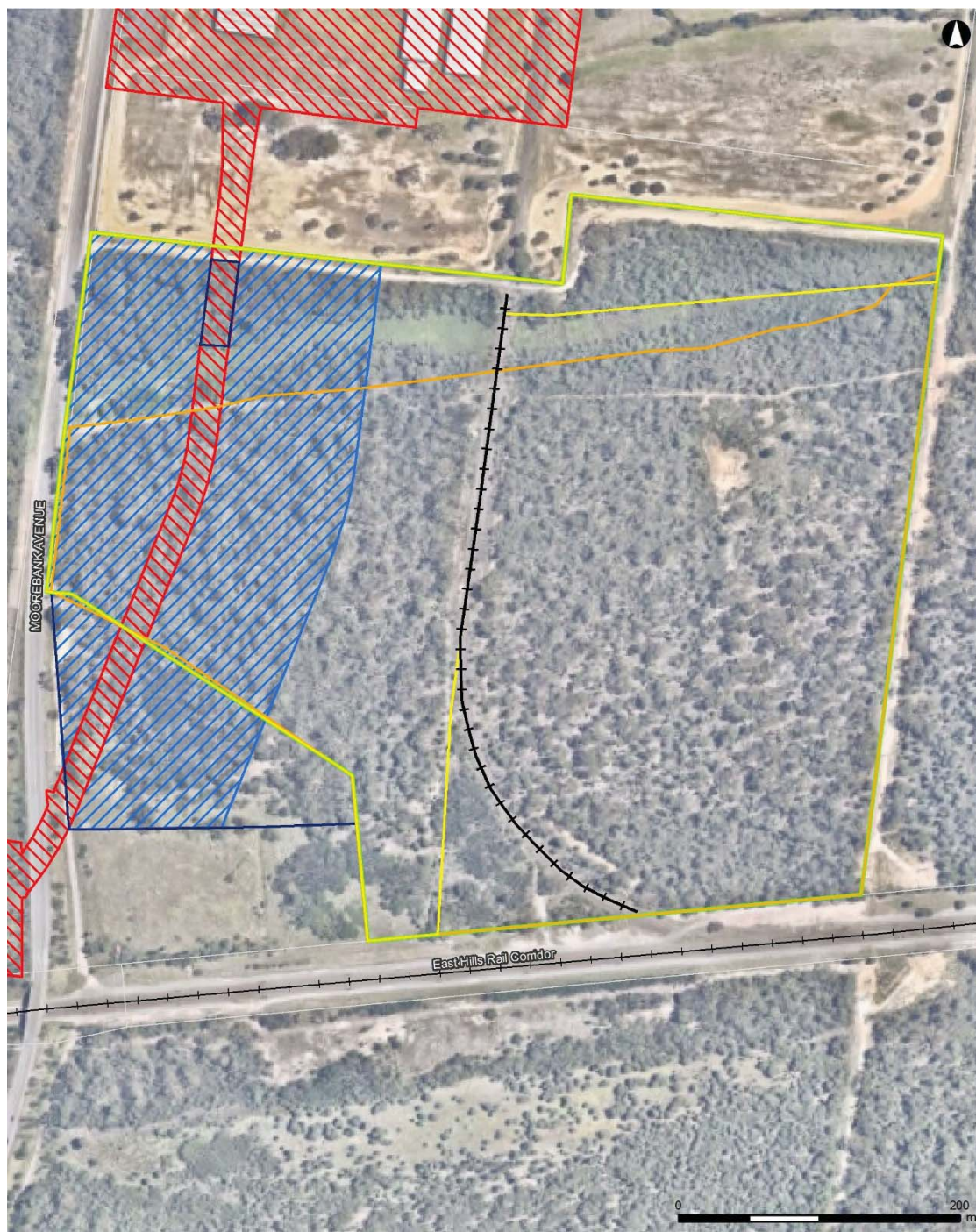
It is considered unlikely that *Hibbertia fumana* or *Acacia bynoeana* would occur within or adjacent to the MPE Stage 1 footprint, given the absence of suitable potential habitat and the recent detailed targeted surveys for these species; as such, no specific management measures would be required for these species. However, as an additional precaution it is recommended that pre-clearance surveys target these species.

#### **References**

Hyder Consulting (2015) *SIMTA Stage 1: Biodiversity Assessment Report*. Hyder Consulting, North Sydney.

OEH (2016) *NSW Guide to Surveying Threatened Plants*. State of New South Wales and Office of Environment and Heritage 2016.





#### LEGEND

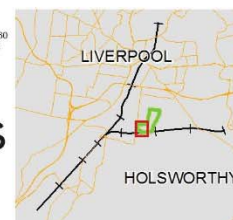
- MPE Stage 1 SSD 14-6766 development footprint (impacted area)
- Adjoining areas (within 100 metres)
- Existing disused Defence rail spur
- Area surveyed July 2012
- Area surveyed November 2014-January 2015
- Area surveyed October-November 2016
- Area surveyed February 2017

ARCADIS AUSTRALIA PACIFIC PTY LTD  
 ABN 76 104 485 269  
 Level 5, 141 Walker St | North Sydney NSW 2060  
 P: +61 (0) 2 8907 9000 | F: +61 (0) 2 8907 9001

Scale: 1:4,075 @ A4

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SIMTA



Date: 9/03/2017 Path: F:\AA008766\GIS\CurrentB\_Maps\Ecology\Hibberia\_figures\Hibberia\_MPE1\_CFFMP\_memo\_figures\Figure\_1\_Site\_and\_survey\_locations\_01032017\_v2\_T1.mxd  
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Figure 1. Location of areas surveyed in October-November 2016 and February 2017



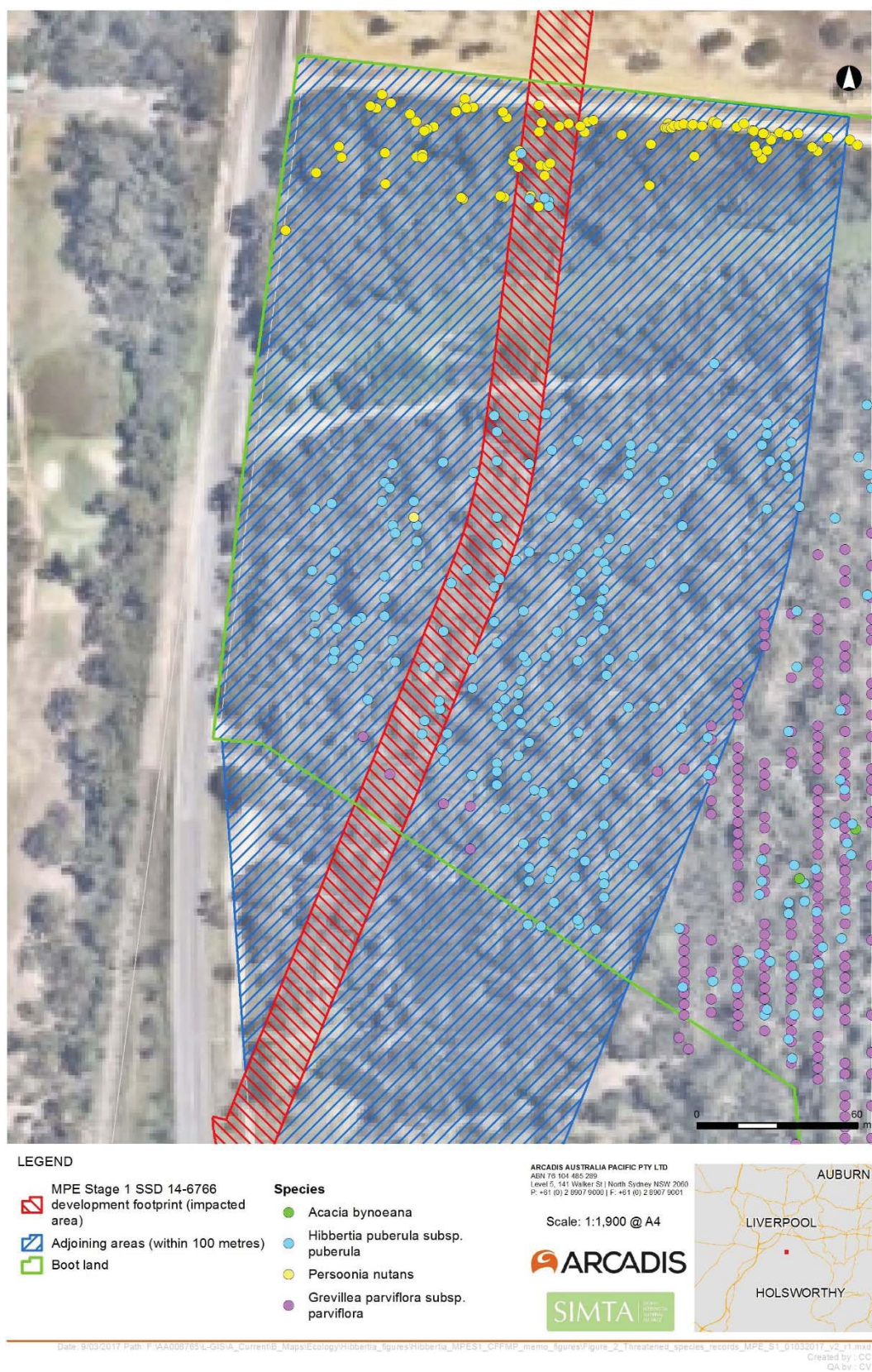


Figure 2. Locations of threatened plant species recorded in October-November 2016 and February 2017 in relation to the MPE Stage 1 Rail link





*Figure 3. 1986 aerial photograph showing clearing associated with construction of existing Defence rail spur and East Hills rail corridor. Extract from Figure A6 of AHMS (2012) Aboriginal Cultural Heritage Assessment prepared for SIMTA Part 3A Concept application.*

## Attachments

### Attachment J: Hibbertia Species Survey Plan

22 June 2018

[REDACTED]  
[REDACTED]  
[REDACTED]  
via email [REDACTED]  
[REDACTED]

**MOOREBANK PRECINCT EAST: STAGE 1 RAIL CORRIDOR HIBBERTIA  
PRE-CLEARANCE SURVEYS**

Dear [REDACTED]

Cumberland Ecology  
PO Box 2474  
Carlingford Court 2118  
NSW Australia  
Telephone (02) 9868 1933  
Mobile 0425 333 466  
Facsimile (02) 9868 1977  
Web: [www.cumberlandecology.com.au](http://www.cumberlandecology.com.au)

The purpose of this letter is to provide the results of the pre-clearance surveys, conducted by Cumberland Ecology between 9 and 14 November 2017, for threatened *Hibbertia* species within the Stage 1 Moorebank Precinct East (MPE) Rail Corridor of the Moorebank Intermodal Project as well as an assessment of the suitability of the Wattle Grove offset area to meet the full quantum of biodiversity offset credits required.

As you are aware, during the Land and Environment Court (LEC) proceedings for Case 2017/81889, the Minister proposed, and Qube has agreed to, a condition of consent for Stage 1 MPE of the Moorebank Intermodal Project that requires pre-clearance surveys for *Hibbertia fumana* and *Hibbertia puberula* be conducted under a Hibbertia Species Survey Plan prepared in consultation with the NSW Office of Environment and Heritage (OEH) to the satisfaction of the Secretary.

On 13 March 2018 the LEC delivered judgment confirming the grant of consent to State Significant Development application SSD 6766. One condition of approval, Condition C23, requires pre-clearance surveys for the *Hibbertia* species. Specifically Condition C23 states that '*Prior to the commencement of clearing within the railway corridor between the southern boundary of the terminal site and the eastern side of the approved Moorebank Avenue Bridge, the Applicant must prepare and implement a Hibbertia Species Survey Plan to determine the number of individual plants of each Hibbertia species present within the corridor and confirm that the required quantum of biodiversity offset credits needed to provide an offset for the surveyed number of individual plants of each Hibbertia species can be achieved. The survey plan, including the survey method, must be prepared in consultation with OEH to the satisfaction of the Secretary. Results of the survey must be included in the Biodiversity Offset Package required by C23A*'.



As the draft conditions of approval were agreed between the Applicant and Respondent in October 2017, this condition of approval was known in spring 2017.

Both *Hibbertia* species are cryptic and so surveys are required to be conducted during flowering to maximise counts of above ground individuals. In 2017, the best available information indicated that:

- *Hibbertia fumana* flowers between September and November, and
- *Hibbertia puberula* flowers in November 2016.

Therefore, November was chosen for the surveys because of the flowering period of the two species. Following consultation with Greg Steenbeeke, senior botanist at OEH, the pre-clearance surveys were conducted from 9-14 November 2017.

The pre-clearance surveys provided detailed, updated estimates of numbers of plants of each species within the development footprint. After the completion of the pre-clearance surveys, additional surveys were conducted by Cumberland Ecology within the proposed offset areas to confirm that sufficient biodiversity offset credits were available for each *Hibbertia* species within the Wattle Grove offset area (also known as the 'Bootland') in November 2017 and January 2018. Further offset site surveys were also conducted by Arcadis in early 2018. The offset site surveys and related calculations confirm that sufficient credits are generated for each species within the Wattle Grove offset area to fully meet the of biodiversity offset credits required for each species.

The results of our pre-clearance surveys and offset surveys are detailed in **Appendix A** to this letter. Figures showing locations of the *Hibbertia* species are provided in **Appendix B**, photographs are provided in **Appendix C**, correspondence with Greg Steenbeeke (OEH) in relation to the pre-clearance survey methodology is provided in **Appendix D**, a summary of pre-clearance field data is provided in **Appendix E** and correspondence between Cumberland Ecology, Arcadis, Tactical Group, OEH and Department of Planning & Environment in relation to the 'Area of Occupancy' methodology for offsets is provided in **Appendix F**.

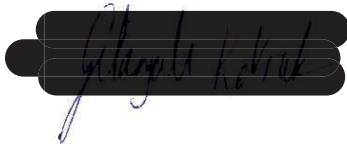
The compliance with all components of Condition C23 is summarised in **Table 1** below.

**Table 1      Assessment of Compliance**

Condition C23 Component	Compliance
1. Prepare <i>Hibbertia</i> Species Survey Plan (HSSP)	HSSP prepared by Cumberland Ecology: Document REF: 17068 Let6, dated 5 June 2018. Updated document with compliance Table and OEH correspondence as per DPE letter dated: 8 June 2018 REF: 17068 Let6v2, dated 22 June 2018
2. Determine the number of individual plants of each <i>Hibbertia</i> species present within the corridor	Preclearance surveys of the rail corridor conducted to determine numbers of individual plants of each <i>Hibbertia</i> species. The Methodology and results of the preclearance surveys are described in <b>Sections A.2.1, A.2.2 and A.3.1 of Appendix A</b> and in <b>Figure 1 and Figure 3 of Appendix B</b> of the HSSP. Correspondence with OEH on approval for pre-clearance survey methods is provided in <b>Appendix D</b> and field notes from preclearance surveys is provided in <b>Appendix E</b> .
3. Confirm that the required quantum of biodiversity offset credits needed to provide an offset for the surveyed number of individual plants of each <i>Hibbertia</i> species can be achieved	An assessment, based on the Area of Occupancy method defined by OEH during a meeting on 16 May 2018, confirmed that the required quantum of biodiversity offset credits can be achieved. The methodology and results for determining quantum of credits are described in <b>Sections A 2.3, A 2.4, A.3.2, A.3.3, A.3.4, A.4.1 and A.4.2 of Appendix A</b> and in <b>Figure 4 of Appendix B</b> . Correspondence with OEH in relation to the suitability of the 'Area of Occupancy' method is provided in <b>Appendix F</b> .
4. The survey plan, including the survey method, must be prepared in consultation with OEH	Correspondence and OEH approval for the pre-clearance field survey method is provided in <b>Appendix D</b> . Correspondence and OEH approval of the 'Area of Occupancy' method for determining quantum of offsets is provided in <b>Appendix F</b> .
5. Results of the survey must be included in the Biodiversity Offset Package required by C23A	The most recent HSSP (Ref: 17068 Let6, dated 22 June 2018) will be included in the Biodiversity Offset Package being prepared by Arcadis

If any further information is required, or if you would like to discuss this matter further, please do not hesitate to contact myself, or Dr David Robertson, on (02) 9868 1933.

Yours sincerely

A handwritten signature in blue ink, which appears to read "Gitanjali Khatrak", is written over a black rectangular redaction box.

  
Senior Project Manager/Ecologist

  
[gitanjali.khatrak@cumberlandecology.com.au](mailto:gitanjali.khatrak@cumberlandecology.com.au)

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*Appendix A*

MPE Stage 1 Rail Link: Hibbertia Pre-  
clearance Survey

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## A.1 Background

Cumberland Ecology was requested by Qube Property Management Services (Qube) to conduct a pre-clearance assessment for the Stage 1 Rail Link of the Moorebank Precinct East (MPE) component of the Moorebank Intermodal Terminal project.

The pre-clearance surveys were conducted to fulfil the field component requirements of a proposed Condition 23 as agreed to by the Minister and Qube during the Land and Environment Court (LEC) proceedings for Case 2017/81889 and which was subsequently imposed by the LEC in the judgment in the proceedings delivered on 13 March 2018.

Condition 23a states that '*Prior to the commencement of clearing within the railway corridor between the southern boundary of the terminal site and the eastern side of the approved Moorebank Avenue Bridge, the Applicant must prepare and implement a Hibbertia Species Survey Plan to determine the number of individual plants of each Hibbertia species present within the corridor and confirm that the required quantum of biodiversity offset credits needed to provide an offset for the surveyed number of individual plants of each Hibbertia species can be achieved. The survey plan, including the survey method, must be prepared in consultation with OEH to the satisfaction of the Secretary. Results of the survey must be included in the Biodiversity Offset Package required by C23A.*'

*Hibbertia fumana* is listed as Critically Endangered under the NSW *Biodiversity Conservation Act 2016* (BC Act) (replacing the repealed NSW *Threatened Species Conservation Act 1995*) while *Hibbertia puberula* ssp. *puberula* (hereafter referred to as *Hibbertia puberula*) is listed as Endangered under the BC Act. Neither species is currently listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

In spring 2017, the best available information indicated that:

- *Hibbertia fumana* flowers between September and November, and
- *Hibbertia puberula* flowers in November.

Therefore, although a final decision on the proposed condition C23a was yet to be made as part of the LEC proceedings at the time, it was considered prudent to conduct the pre-clearance surveys in November 2017.

Cumberland Ecology contacted OEH (email from Gitanjali Katrak to senior botanist Greg Steenbeeke, dated 6 November 2017) to determine a suitable field methodology for the pre-clearance surveys. OEH approval of the survey period and proposed field methodology was granted via email on 6 November 2017 (email from Greg Steenbeeke to Gitanjali Katrak) following clarification and a phone discussion on 6 November between Greg Steenbeeke and Gitanjali Katrak (see **Appendix D** for correspondence with OEH).

## A.2 Methodology

### A.2.1 Pre-clearance Surveys

The pre-clearance surveys of the MPE Stage 1 Rail corridor (the rail corridor) were conducted over three days from 9 - 14 November 2017 by Cumberland Ecology Senior Ecologist Gitanjali Katrak (9th, 13th, 14th), and Botanists Bryan Furchert (9th) and Rohan Mellick (13-14th).

Surveys were limited to parts of the rail corridor to the east of Moorebank Avenue from the southern boundary of the terminal site and the eastern side of the approved Moorebank Avenue Bridge. Prior to the pre-clearance surveys, the alignment of the rail corridor along with an additional work 'buffer,' was marked out by a surveyor, using orange 'witches hats' and spray painting the ground.

The area within the surveyors' marked-up alignment was completely traversed by the attending ecologists. Hand-held GPS units were utilised to maintain track logs to verify that all areas of the marked up rail corridor alignment were traversed (**Figure 1 of Appendix B**). Photographs and GPS locations of areas deemed unlikely to support *Hibbertia* species (eg creekline areas, areas with dense understorey) were taken during the surveys.

The locations of all *Hibbertia* individuals detected were individually recorded by GPS. Each recorded individual was also tagged with a small numbered metal tag (either on the *Hibbertia* individual itself if feasible or on vegetation immediately adjacent to it) and high visibility pink flagging tape was utilised to mark the locations of the recorded individuals.

### A.2.2 *Hibbertia* field identification

At the time of the pre-clearing surveys in November 2017 and subsequent offset site surveys in November 2017 and January 2018, Qube had undertaken not to clear any vegetation within Lot 4 of DP 1197707. Therefore, plant samples could not be collected for laboratory identification and individuals had to be identified in the field. The characteristics summarised in **Table 2** below were examined in the field, using hand lenses as required, to distinguish between individuals of *Hibbertia fumana* and *Hibbertia puberula*. These characteristics comprise a combination of characteristics as defined on the National Herbarium of NSW (PlantNet) profiles for each species, descriptions provided in the journal article on *Hibbertia* species by Toelken and Miller (2012) and observations from previous surveys.

**Table 2** Field identification characteristics for *Hibbertia* species

<i>Hibbertia fumana</i>	<i>Hibbertia puberula</i>
Flower (including dried or dropped individuals) with 5 -7 stamens	Flower (including dried or dropped individuals) with 9+ stamens
Buds with elongated peduncle or remnant peduncle if bud/flower dropped	Buds without elongated peduncle or buds in clusters (2+)
Outer calyx lobes without ridge	Outer calyx lobes 'beaked' with ridge near apex

**Table 2** Field identification characteristics for *Hibbertia* species

<i>Hibbertia fumana</i>	<i>Hibbertia puberula</i>
Stellate and simple hairs present	Only simple hairs present

It is noted that these characteristics could not be conclusively identified on some smaller individuals in the field, due to limitations of field equipment. These individuals are therefore listed as *Hibbertia* species.

### **A.2.3 Offset Site surveys**

Following the pre-clearance surveys, additional surveys were conducted by Cumberland Ecology staff Gitanjali Katrak and Bryan Furchert within the Wattle Grove offset area (also known as the Bootland) on 27-28 November 2017. The focus of the offset site surveys was to determine any additional areas that support both *Hibbertia* species to ensure that the biodiversity credits needed to offset for the surveyed number of individual plants of each *Hibbertia* species can be achieved.

The surveys involved random meander surveys in the parts of the Bootland to the east and south of the known occurrences of *Hibbertia puberula* and *Hibbertia fumana* as recorded in 2016 and 2017 surveys by Arcadis (Arcadis 2017). The locations of any individuals detected were recorded using a hand-held GPS unit and vegetation adjacent to the *Hibbertia* individuals was marked using pink flagging tape.

Additional surveys to verify the area of occupancy of *Hibbertia puberula* were conducted by Cumberland Ecology staff Gitanjali Katrak and Rohan Mellick on 25 January 2018. The purpose of these surveys was to confirm the occurrence of *Hibbertia puberula* across the entirety of the main occupancy zone as mapped by Arcadis.

The survey area was roughly divided into nine sampling zones (**Figure 2 of Appendix B**) based on the known records of *Hibbertia puberula* recorded by Arcadis in 2016 and early 2017 and random point locations were generated within the mapped sampling zones using GIS. A total of 112 random point locations were distributed across the 9 sampling zones.

The random points were located in the field using a hand-held GPS unit and occurrence of *Hibbertia puberula* in the vicinity of each random point was noted. Opportunistic observations of *Hibbertia puberula* within the nine sampling zones while meandering between random points were also noted.

### **A.2.4 Credit Requirement calculations**

#### *i. Credit Ratios*

As all works within the BioBanking calculator to date, as required under the Framework for Biodiversity Assessment (FBA) for the MPE project, have been conducted by Arcadis, a formal

calculation of credit requirements has not been run through the BioBanking calculator. However the credit requirements for each species as outlined in the 2017 BAR prepared by Arcadis have been utilised to determine that the proposed offsets are sufficient to meet the credit requirements for each species.

It is noted that the credit ratios provided in the 2017 BAR relate to credit requirements per individual. However it is understood that, following discussions with DPE and OEH on 16 May 2018, a change in the unit of measurement from individual plants to area of habitat (i.e 1 plant to 1 ha) has been deemed suitable by OEH (see **Appendix F** for correspondence). Therefore the credit ratios/individual as listed in the 2017 BAR have been converted to credit ratios/ha for each species.

#### ii. *Area of Occupancy*

The area of occupancy polygons for *Hibbertia fumana* and *Hibbertia puberula* within the development footprint and offset sites were derived by applying a 30 metre buffer to each of the existing records for each species (as recorded in various surveys conducted by Arcadis, WSP Parsons Brinkerhoff and Cumberland Ecology) and dissolving the overlapping boundaries, a method consistent with Section 6.4.1.29 of the Biodiversity Assessment Method 2017.

Mapping of the area of occupancy was conducted by Arcadis and WSP Parsons Brinkerhoff and reviewed by Cumberland Ecology.

## A.3 Results

### A.3.1 Pre-clearance surveys

The marked up rail alignment corridor was completely traversed by Cumberland Ecology staff (**Figure 1 of Appendix B**). During the surveys it was observed that both *Hibbertia* species were absent from areas with extremely dense exotic grass cover (**Figure 1** – PP1 and PP2), damp low-lying areas (PP3), areas of extremely dense bush (PP4 – PP5) and in the vicinity of Anzac Creek (PP6 – PP8). Photographs showing conditions at these eight photopoint locations are provided in **Appendix C**.

All recorded individuals of *Hibbertia fumana* in the rail alignment were concentrated in the disturbed 'slashed zone' immediately south of the terminal site (**Figure 3 of Appendix B**). *Hibbertia puberula* individuals largely occurred in the 'slashed zone' as well as bushland areas south of Anzac Creek with some scattered individuals located in bushland north of Anzac Creek (**Figure 3**).

*Hibbertia puberula* was largely in bud during surveys. Flowering individuals largely occurred only in the bushland areas south of Anzac Creek which was surveyed on 14 November 2017. No flowering individuals of *Hibbertia fumana* were recorded. The condition of *Hibbertia fumana* individuals varied with some having dried/dropped flowers at the base while others appeared to be coming into bud.

A total of 383 *Hibbertia* individuals were recorded within the rail alignment. Of this 171 individuals were confirmed as *Hibbertia fumana* and 180 were confirmed as *Hibbertia puberula*. A further 13 individuals were tentatively identified as *Hibbertia fumana* and six as *Hibbertia puberula* based on visible field characteristics. As the characteristics used for identification were limited on these individuals, further laboratory analysis of samples would be required to verify these identifications. A further 13 individuals lacked sufficient material to make any tentative field identifications. A summary of recorded individuals is provided in **Appendix E**.

New growth was recorded in parts of the slashed zone. However due to the sprawling nature of both *Hibbertia* species, newly sprouted growth could not always be conclusively determined as part of a sprawling individual or as a new individual without risking damage to the plants due to excessive handling. Tagging of such plants was also not feasible due to the size of the new sprouts and lack of suitable adjacent vegetation. Therefore recording of these new sprouts was limited to notations of occurrence adjacent to the closest tagged individual (**Appendix E**).

### **A.3.2 Offset site surveys**

The offset site surveys, conducted on 27-28 November 2017, were largely concentrated in the eastern and southern parts of the Bootland.

Both *Hibbertia fumana* and *Hibbertia puberula* were recorded at new locations in the eastern parts of the 'Bootland'. Additional records of both species were also found the southern 'Bootland', resulting in minor extensions to the area of occupancy of both species, as recorded by Arcadis.

A total of 125 *Hibbertia fumana* (122 confirmed and three tentative) and 82 *Hibbertia puberula* individuals were recorded within the 'Bootland' area during the November 2017 surveys. While some records may overlap with those previously recorded by Arcadis, a conservative estimate is that at least 100 *Hibbertia fumana* and 70 *Hibbertia puberula* comprise newly recorded individuals.

The January 2018 surveys conducted by Cumberland Ecology confirmed the presence of *Hibbertia puberula* across the entirety of the nine sampling zones. No targeted surveys were conducted outside these sampling zones. However it is understood that further detailed targeted surveys were conducted by Arcadis in late 2017 – early 2018 in the wider Bootland area and additional individuals of *Hibbertia puberula* were recorded to the east and north-east of the nine zones surveyed by Cumberland Ecology in January 2018.

### **A.3.3 Area of Occupancy**

The area of occupancy of each individual species within the rail corridor and Wattle Grove offset area, as mapped by Arcadis and WSP Parsons Brinkerhoff and reviewed by Cumberland Ecology, is provided in **Figure 4** of **Appendix B**. It should be noted that mapped areas of occupancy for both species that extend outside the boundaries of the proposed rail corridor and the offset site are not indicated in this figure.

A total of 13 *Hibbertia* individuals recorded within the rail corridor during the pre-clearance surveys were not identified to species level due to insufficient material for field identification.



*Hibbertia fumana* is listed as Critically Endangered under the BC Act whereas *Hibbertia puberula* is listed as Endangered under the BC Act. Under the FBA trading rules, it is permissible to offset impacts for a species by providing offsets for a related species of equal or higher listing. Thus impacts for removal of *Hibbertia puberula* can be offset by providing additional offsets for *Hibbertia fumana*. Therefore a precautionary approach has been taken and it is assumed that the 13 unidentified individuals comprise *Hibbertia fumana*. These individuals all occur within the mapped area of occupancy for *Hibbertia fumana* and therefore are included the area of occupancy calculations for *Hibbertia fumana* within the development site.

Based on the provided occupancy mapping, the following areas of occurrence outlined in Table 3, have been calculated for each *Hibbertia* species within the development site and offset site.

**Table 3 Area of Occupancy of *Hibbertia* species**

Location	Species	Area of Occupancy (ha)
Development Site	<i>Hibbertia fumana</i>	0.26
Offset Site	<i>Hibbertia fumana</i>	10.20
Development Site	<i>Hibbertia puberula</i>	0.74
Offset Site	<i>Hibbertia puberula</i>	24.66

#### A.3.4 Credit Estimates

Based on the values provided in the 2017 BAR and approval of the change in unit of measurement by OEH, the offset ratios in **Table 4** below have been utilised for credit calculations within this report.

**Table 4 Credit ratios for *Hibbertia* species**

Area	Species	Credits
Development Site	<i>Hibbertia fumana</i>	77 credits/ha of habitat removed
Development Site	<i>Hibbertia puberula</i>	40 credits/ha of habitat removed
Offset Site	<i>Hibbertia fumana</i>	7 credits/ha of habitat conserved
Offset Site	<i>Hibbertia puberula</i>	7 credits/ha of habitat conserved

## A.4 Impact Assessment and Credit Balances

### A.4.1 *Hibbertia fumana*

Based on the credit requirement estimate of 77 credits/ha for *Hibbertia fumana* in the development site, the removal of ~0.26 ha of habitat equates to a credit requirement of 20 credits for *Hibbertia fumana*.

Based on the credit generation estimate of seven credits/ha for *Hibbertia fumana* in the offset site, the area of occupancy of ~10.20 ha within the Biobank site equates to a credit generation of 72 credits. This leaves a surplus balance of 39 credits for *Hibbertia fumana* within the Biobank Site.

Therefore, there are sufficient credits generated within the Bootland offset to meet the credit requirement for the removal of ~0.26 ha of *Hibbertia fumana* habitat within the rail corridor. A credit balance of 52 credits remains after impacts from the removal of ~0.26 ha of *Hibbertia fumana* habitat is offset. This is summarised in Table 5 below.

**Table 5 Credit Balances for *Hibbertia fumana***

Area of Occupancy (ha)	Credit ratio/ha	Credits required/generated*	Credit Balance
0.26	77	20	52
10.20	7	72	

\* Estimated credits are rounded off to the nearest whole number

### A.4.2 *Hibbertia puberula*

Based on the credit requirement estimate of ~40 credits/ha for *Hibbertia puberula* in the development site the removal of ~0.74 ha of habitat equates to a credit requirement of 30 credits for *Hibbertia puberula*.

Based on the credit generation estimate of seven credits/individual for *Hibbertia puberula* in the offset site, the area of occupancy of ~24.66 ha within the Biobank site equates to a credit generation of ~175 credits. This leaves a surplus balance of 145 credits for *Hibbertia puberula* within the Biobank Site.

Therefore there are sufficient credits generated within the Bootland offset to meet the credit requirement for the removal of ~0.74 ha of *Hibbertia puberula* habitat within the rail corridor. A credit balance of 145 credits remains after impacts from the removal of ~0.74 ha of *Hibbertia puberula* habitat is offset as summarised in **Table 6** below.

**Table 6 Credit Balances for *Hibbertia puberula***

Area of Occupancy (ha)	Credit ratio/ha	Credits required/generated*	Credit Balance
0.74	40	30	145
24.66	7	175	

\* Estimated credits are rounded off to the nearest whole number

## A.5 Conclusion

A total of ~0.26 ha of *Hibbertia fumana* habitat and ~0.74 ha of *Hibbertia puberula* habitat will be removed from within the MPE Stage 1 rail corridor.

Based on the area of occupancy of *Hibbertia fumana* (~10.20 ha) and *Hibbertia puberula* (~24.66 ha) within the Bootland offset site, the required quantum of biodiversity credits needed to provide an offset for the surveyed number of *Hibbertia fumana* and *Hibbertia puberula* individuals within the rail corridor is achieved.

## A.6 References

Arcadis (2017). Sydney Intermodal Terminal Alliance (SIMTA) Moorebank Project East Stage 1: Biodiversity Assessment Report, dated October 2017.

Toelken, H.R. and Miller R.T. (2012). Notes on *Hibbertia* (Dilleniaceae) 8. Seven new species, a new combination and four new subspecies from subgen *Hemistemma*, mainly from the central coast of New South Wales. *Journal of the Adelaide Botanic Gardens* 25: 71-96.

Plantnet (2017): *Hibbertia fumana*. <http://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=sp&name=Hibbertia~fumana>

Plantnet (2017): *Hibbertia puberula ssp puberula*. <http://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=in&name=Hibbertia~puberula+subsp.~puberula>

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*Appendix B*

**Figures**

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Figure 1. Pre-clearance survey effort within MPE Stage 1 Rail Link





Figure 2. *Hibbertia puberula* density estimate survey zones



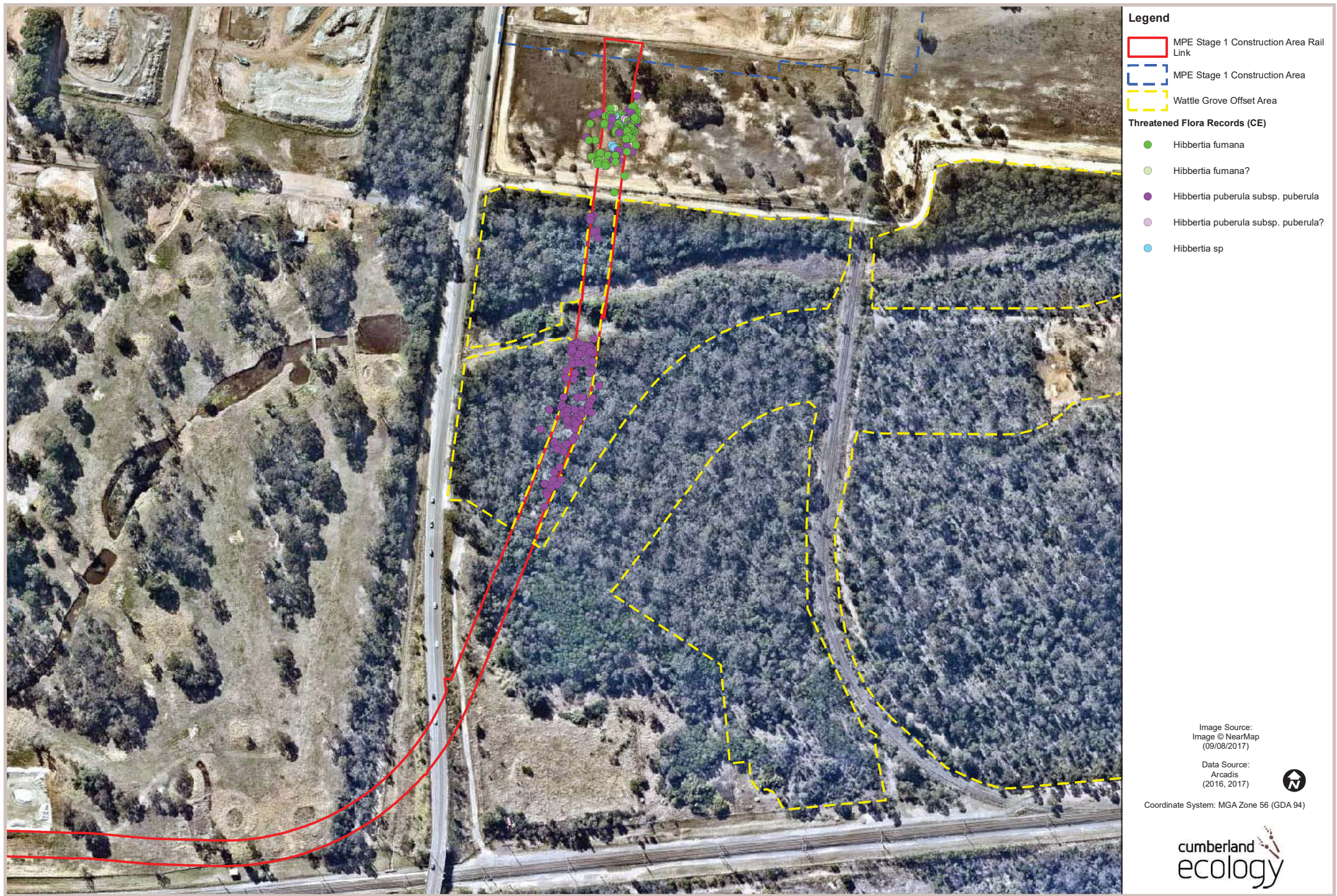


Figure 3. Hibbertia species within MPE Stage 1 Rail Link (Nov 2017 Pre-clearance records)





Figure 4. Hibbertia species - Area of occurrence within Wattle Grove offset area and Rail Corridor



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*Appendix C*

Photographs

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**Photograph 1** Embankment from Moorebank Avenue dominated by *Eragrostis curvula* and *Cenchrus clandestinus* (PP1)



**Photograph 2** Exotic dominated vegetation within Railcorp land (PP2)





**Photograph 3**      *Hydrotyle bonariensis* in damp low-lying areas (PP3)



**Photograph 4**      Dense vegetation near RailCorp Land fenceline (PP4)





**Photograph 5**      **Dense vegetation north of Railcorp land (PP5)**



**Photograph 6**      ***Typha* and sedge dominated vegetation and adjacent Bamboo grove along Anzac Creek (PP6)**





**Photograph 7**      **Southern side of Bamboo grove (PP7)**



**Photograph 8**      **Close up of Bamboo density (PP8)**





Photograph 9      *Hibbertia fumana* bud with elongated peduncle (November 2017)



Photograph 10      *Hibbertia puberula* with multiple bud clusters (November 2017)



Photograph 11      Remnant peduncle on *Hibbertia fumana* (November 2017)



Photograph 12      *Hibbertia puberula* flower with 9+ stamens (November 2017)





Photograph 13 Tagged *Hibbertia puberula* individual (November 2017)



Photograph 14 Sprawling *Hibbertia puberula* individual (November 2017)

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*Appendix D*

Correspondence with OEH: Pre-clearance  
surveys

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**From:** Gitanjali Katrak  
Greg Steenheke  
David Robertson Lauren Sims Andrew Beattie Richard Bonner Susan Harrison  
Rourke, Felicity  
**Date:** Monday, November 6, 2017 2:53:00 PM

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Hi Greg,

To clarify your queries:

- The surveyors will be marking out the centreline of the rail track using spray marks and will be marking up the boundaries of the rail corridor using plastic witches hats. No vegetation will be cleared for these works.
- As per our discussion earlier today, for the pre-clearance surveys – we propose to ‘section’ the rail corridor into 5 -10m ‘blocks’ (running roughly north-south). The surveys will be done by two ecologists, with each ecologist surveying alternate ‘blocks’. This is mainly to help concentrate survey effort and ensure that the entire rail corridor is traversed.
- We will be using tags/GPS waypoint for each individual plant and will be using different coloured flagging tape to indicate the locations of the two different species.

The data you requested for the abundance estimates for *H.fumana* is not held by Cumberland Ecology – I’ve notified the client of your request and will hopefully be able to get back to you on this shortly.

Regards,

Gitanjali Katrak

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**From:** [REDACTED]  
**Sent:** Monday, 6 November 2017 10:11 AM  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** RE: OEH input for MPE Stage 1 Hibbertia pre-clearance surveys

Hello [REDACTED]

I appreciate you sending this through to me, and agree, time is of the essence. The recent rainfall will assist with inducing both species into flower, so that will also be advantageous.

I have a couple of questions which I hope that you / Qube can answer to my satisfaction also.

- With regard to the surveyor marking out the boundary of the corridor, are they to implement standard practice of cutting sight lines, or will they be merely running flagging through the existing vegetation to demarcate the alignment? If they are cutting vegetation to put through

a sight line, can they please put any cut woody vegetation (shrubs etc.) on the outside of the alignment to ensure that none of the ground is obscured when undertaking the survey. Some of the undergrowth density of shrubs is quite high and that would result in a reasonably large amount of material within the targeted area for search. I would also request that the minimum amount of trampling occur in running that alignment.

- With regard to the sectioning of the corridor, how large are these sections, or how many are you contemplating? Thank you for obtaining and keeping track logs.
- Thank you for recording all individuals individually. Please use a unique identifier code and a separate GPS record for each plant of *H. fumana* in particular, but both species if possible (I recognise that there are likely 2 orders of magnitude difference in counts of each). I do not wish to have single points representing multiple individuals of *H. fumana* (although the code for *H. puberula* could be constructed such that the code contains a recognition of individuals within the nominated unit square).

I am in the office today (6<sup>th</sup>) but not tomorrow. If you have any questions I am more than happy to discuss these and any matters of your own design you wish to elaborate upon.

As an aside, would it be possible to forward the data from all quadrats assessed earlier from which the data was used to determine abundance and distribution of *H. fumana*? I would like to look at the data in relation to the survey method and results presented previously to confirm to myself that the density and abundance data are as presented in item 76 of the Expert Report that David prepared (before I update the profile page for the species). I didn't get enough clarity in the information presented in the BAR and the ER about how the null-find quadrats were accounted for in the determining of the density and zones.

Thanks in advance [REDACTED]

[REDACTED] Greg Steenbeeke

Senior Threatened Species Officer

Ecosystems and Threatened Species Team

Greater Sydney Branch, Regional Operations Division

Office of Environment and Heritage

Street: 43 Bridge St Hurstville NSW 2220

Mail: PO Box 1967, Hurstville BC, NSW 1481

E: [greg.steenbeeke@environment.nsw.gov.au](mailto:greg.steenbeeke@environment.nsw.gov.au)

T: (02) 9585 6677 fax: 9585 6442 mob: 0402 068 489

W: [www.environment.nsw.gov.au](http://www.environment.nsw.gov.au)

OrcID: 0000-0003-1317-9241 LinkedIn: <https://au.linkedin.com/in/greg-steenbeeke-48443862>

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From: [REDACTED] <mailto:gitanjali.katrak@cumberlandecology.com.au>

Sent: Monday, 6 November 2017 8:17 AM

To: [REDACTED] [Greg.Steenbeeke@environment.nsw.gov.au](mailto:Greg.Steenbeeke@environment.nsw.gov.au)

[REDACTED] [david.robertson@cumberlandecology.com.au](mailto:david.robertson@cumberlandecology.com.au)

Subject: IMP: OEH input for MPE Stage 1 Hibbertia pre-clearance surveys

Importance: High

Hello [REDACTED]

As you are aware, the Minister has proposed (and Qube has agreed to) a condition of consent for

Stage 1 MPE of the Moorebank Intermodal Project that requires pre-clearance surveys for *Hibbertia fumana* and *Hibbertia puberula* under a Hibbertia Species Survey Plan prepared in consultation with OEH to the satisfaction of the Secretary (Condition 23a as agreed to by the Minister and Qube, but not yet imposed by the Court is provided verbatim below).

Qube has requested Cumberland Ecology to conduct these surveys. The available information to date indicates that *Hibbertia fumana* was flowering in Sep-Oct 2017 and was flowering in Nov 2016. *Hibbertia puberula* was also confirmed as flowering in Nov 2016.

As the extent of the flowering period for *Hibbertia fumana* is unknown, we believe it is prudent to commence pre-clearance surveys in November in order to more readily detect both Hibbertia species and gain a more accurate count of the number of each Hibbertia species present within the rail corridor. It is our understanding that a surveyor will be marking out the boundary of the corridor, with an additional buffer. Our proposed methodology for the planned November pre-clearance surveys is:

- The rail corridor will be divided into 'sections' for survey
- Each section will be completely traversed by an ecologist (a hand-held GPS with track log will be utilised to confirm the section is traversed completely) targeting *Hibbertia fumana* and *Hibbertia puberula*
- The locations of all individuals detected will be recorded using the GPS and will also be tagged in the field. Tags will include small metal tags (either on the Hibbertia individual itself or on vegetation immediately adjacent to it. Hi-vis flagging tape on adjacent/overhanging vegetation will also be used to mark the location of recorded individuals)
- In the event that *Hibbertia puberula* is not yet flowering at the time of the planned November surveys, the process is to be repeated for this species once flowering is confirmed.

Could you please confirm that the proposed field methodology above is satisfactory. This methodology will be incorporated into the Hibbertia Species Survey Plan along with a schedule for follow up surveys if deemed necessary. If you consider that further refinement of the field methodology is required, would you be available to discuss this matter on 6<sup>th</sup> or 7<sup>th</sup> Nov as we are currently planning to conduct an initial round of surveys commencing 9<sup>th</sup> Nov.

I wish to emphasise that the carrying out of the proposed surveys does not mean that clearing work in connection with the rail corridor is imminent. Rather, Qube wishes to carry out survey work at a time when flowering of the species is expected to be occurring and thereby to ensure that accurate surveying can take place.

Condition 23a

*Prior to the commencement of clearing within the railway corridor between the southern boundary of the terminal site and the eastern side of the approved Moorebank Avenue Bridge, the Applicant must prepare and implement a Hibbertia Species Survey Plan to determine the number of individual plants of each Hibbertia species present within the corridor and confirm that the required quantum of biodiversity offset credits needed to provide an offset for the surveyed number of individual plants of each Hibbertia species can be achieved. The survey plan, including the survey method, must be prepared in consultation with OEH to the satisfaction of the Secretary. Results of the survey must be included in the Biodiversity Offset*

*Package required by C23a.*

Regards,

**Gitanjali Katrak**

Senior Project Manager/Ecologist



w [cumberlandecology.com.au](http://cumberlandecology.com.au)

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*Appendix E*

Hibbertia Pre-clearance Survey - Field ID  
notes

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**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
9/11/2017	21	638	1	<i>Hibbertia puberula</i>	All within a 1m <sup>2</sup> area Tags on adjacent vegetation
9/11/2017	21	639	2	<i>Hibbertia puberula</i>	All within a 1m <sup>2</sup> area Tags on adjacent vegetation
9/11/2017	21	640	3	<i>Hibbertia puberula</i>	All within a 1m <sup>2</sup> area Tags on adjacent vegetation
9/11/2017	21	641	4	<i>Hibbertia puberula</i>	All within a 1m <sup>2</sup> area Tags on adjacent vegetation
9/11/2017	21	642	5	<i>Hibbertia puberula</i>	All within a 1m <sup>2</sup> area Tags on adjacent vegetation
9/11/2017	21	643	6	<i>Hibbertia puberula</i>	Tag above plant
9/11/2017	21	644	7	<i>Hibbertia puberula</i>	buds
9/11/2017	21	645	8	<i>Hibbertia puberula</i>	Buds
9/11/2017	21	646	9	<i>Hibbertia puberula</i>	Tag on adjacent sapling
9/11/2017	21	647	10	<i>Hibbertia puberula?</i>	Looks different, Conservatively ID'd as potential <i>H. puberula</i> . Photos 890-893 - bud without peduncle visible
9/11/2017	21	648	11	<i>Hibbertia puberula</i>	Hairs simple
9/11/2017	21	649	12	<i>Hibbertia fumana</i>	Photo 894-897
9/11/2017	21	650	13	<i>Hibbertia fumana</i>	Slightly elongated peduncle, stellate hairs, ID verification required. Photo 898-900
9/11/2017	21	651	14	<i>Hibbertia fumana?</i>	ID verification required - no buds but hairs appear stellate
9/11/2017	21	652	15	<i>Hibbertia fumana?</i>	ID verification required - no buds but hairs appear stellate
9/11/2017	21	653	16	<i>Hibbertia fumana?</i>	ID verification required - no buds but hairs appear stellate
9/11/2017	21	654	17	<i>Hibbertia fumana?</i>	ID verification required - no buds but hairs appear stellate

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
9/11/2017	21	655	18	<i>Hibbertia fumana</i>	Photo 901-902, Likely <i>H. fumana</i> (slightly elongated peduncle)
9/11/2017	21	656	19	<i>Hibbertia fumana?</i>	ID verification required - no buds but hairs appear stellate
9/11/2017	21	657	20	<i>Hibbertia fumana?</i>	ID verification required - no buds but hairs appear stellate
9/11/2017	21	658	21	<i>Hibbertia fumana?</i>	ID verification required - no buds but hairs appear stellate
9/11/2017	21	659	22	<i>Hibbertia fumana?</i>	ID verification required - no buds but hairs appear stellate
9/11/2017	21	660	23	<i>Hibbertia fumana?</i>	ID verification required - no buds but hairs appear stellate
9/11/2017	21	661	24	<i>Hibbertia fumana</i>	No buds but stellate hairs visible
9/11/2017	21	662	25	<i>Hibbertia fumana</i>	Photo 905-906
9/11/2017	21	663	30	<i>Hibbertia fumana</i>	Photo 907-908
9/11/2017	21	664	31	<i>Hibbertia fumana</i>	Photo 909-910. Bud with start of peduncle but appears beaked - conservatively ID'd as <i>H. fumana</i>
9/11/2017	21	665	32	<i>Hibbertia fumana</i>	ID verification required - no buds but hairs appear stellate
9/11/2017	21	666	33	<i>Hibbertia fumana</i>	ID verification required - no buds but hairs appear stellate
9/11/2017	21	667	34	<i>Hibbertia fumana</i>	No buds but stellate hairs visible
9/11/2017	21	668	35	<i>Hibbertia puberula</i>	Some unusual bud clusters but leaves similar. Photo 911-914
9/11/2017	21	670	41	<i>Hibbertia puberula</i>	Def - Buds (Photo 915-16)
9/11/2017	21	671	42	<i>Hibbertia fumana?</i>	No buds/ dead flowers. ID verification required
9/11/2017	21	672	43	<i>Hibbertia fumana?</i>	No buds/ dead flowers. ID verification required
9/11/2017	21	673	44	<i>Hibbertia puberula</i>	Def - Cluster of 3-4 buds
9/11/2017	21	674	45	<i>Hibbertia puberula</i>	Def - no buds but dead flower with >7 stamens
9/11/2017	21	675	50	<i>Hibbertia puberula</i>	Dead flowers with ~10 stamens

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
9/11/2017	21	676	51	<i>Hibbertia fumana</i>	Flower with slightly elongated peduncle
9/11/2017	21	677	52	<i>Hibbertia fumana</i>	Very small, no buds, ID verification required
9/11/2017	21	678	53	<i>Hibbertia fumana</i>	Very small, no buds, ID verification required
9/11/2017	21	679	54	<i>Hibbertia fumana?</i>	Very small, no buds, ID verification required
9/11/2017	21	680	55	<i>Hibbertia fumana</i>	Dead flowers with ~6 stamens
9/11/2017	21	681	61	<i>Hibbertia puberula</i>	Cluster of buds
9/11/2017	21	682	62	<i>Hibbertia fumana</i>	No buds or dead flowers, ID verification required
9/11/2017	21	683	63	<i>Hibbertia fumana</i>	No buds or dead flowers, ID verification required
9/11/2017	21	684	64	<i>Hibbertia fumana</i>	No buds or dead flowers, ID verification required
9/11/2017	21	685	65	<i>Hibbertia fumana</i>	Dead flower with elongated peduncle
9/11/2017	21	686	68	<i>Hibbertia fumana</i>	Dead flower with elongated peduncle
9/11/2017	21	687	69	<i>Hibbertia fumana</i>	Dead flower with elongated peduncle
13/11/2017	21	688	70	<i>Hibbertia fumana</i>	No material, ID verification required
13/11/2017	21	689	71	<i>Hibbertia fumana</i>	No material, ID verification required
13/11/2017	21	690	74	<i>Hibbertia fumana</i>	Dead flower with elongated peduncle
13/11/2017	21	691	75	<i>Hibbertia fumana</i>	No flower/bud material, ID verification required
13/11/2017	21	692	76	<i>Hibbertia fumana</i>	No flower/bud material, ID verification required
13/11/2017	21	693	77	<i>Hibbertia fumana</i>	Some dead flower at base for new plant sprouting adj
13/11/2017	21	694	78	<i>Hibbertia fumana</i>	Flowering - 6 stamens
13/11/2017	21	695	79	<i>Hibbertia fumana</i>	Flowering - 6 stamens



**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
13/11/2017	21	696	80	<i>Hibbertia puberula</i>	No material, ID verification required, simple hairs
13/11/2017	21	697	89	<i>Hibbertia fumana</i>	Dead flowers, ~4 visible stamens, clustered on one side
13/11/2017	21	698	96	<i>Hibbertia fumana</i>	Dead flowers, ~4 visible stamens, clustered on one side
13/11/2017	21	699	97	<i>Hibbertia puberula</i>	Dried 3 bud cluster + flower with >10 stamens
13/11/2017	21	700	98	<i>Hibbertia puberula</i>	Flower with 9 stamens + 3 bud cluster (Photo 917-920)
13/11/2017	21	701	99	<i>Hibbertia fumana</i>	No flower but remnant long peduncle
13/11/2017	21	702	101	<i>Hibbertia fumana</i>	No flower but remnant elongated peduncle (Photo 926)
13/11/2017	21	703	102	<i>Hibbertia fumana</i>	Dried flower with elongated peduncle
13/11/2017	21	704	103	<i>Hibbertia fumana</i>	Dried flower with elongated peduncle
13/11/2017	21	705	104	<i>Hibbertia puberula</i>	2 bud cluster
13/11/2017	21	706	105	<i>Hibbertia fumana</i>	Flower with 6 stamens
13/11/2017	21	707	110	<i>Hibbertia puberula</i>	Buds with short pedicel
13/11/2017	21	708	111	<i>Hibbertia fumana</i>	Bud with elongated peduncle
13/11/2017	21	709	123	<i>Hibbertia fumana</i>	Bud with elongated peduncle
13/11/2017	21	710	124	<i>Hibbertia fumana</i>	Flower with 6 stamens
13/11/2017	21	711	125	<i>Hibbertia puberula</i>	2 bud cluster
13/11/2017	21	712	126	<i>Hibbertia puberula?</i>	No material, hairs appear simple ID verification required
13/11/2017	21	713	127	<i>Hibbertia puberula</i>	Flower with >10 stamens
13/11/2017	21	714	128	<i>Hibbertia puberula</i>	2-3 bud cluster
13/11/2017	21	715	129	<i>Hibbertia puberula?</i>	Insufficient ID material - verification required. Immediately adj to other <i>H. puberula</i>

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
13/11/2017	21	716	130	<i>Hibbertia puberula?</i>	Insufficient ID material - verification required. Immediately adj to <i>H. puberula</i>
13/11/2017	21	717	131	<i>Hibbertia puberula</i>	Flowering, also new growth starting nearby
13/11/2017	21	718	132	<i>Hibbertia puberula</i>	Flowering, also new growth starting nearby
13/11/2017	21	719	133	<i>Hibbertia fumana</i>	Flowering
13/11/2017	21	720	134	<i>Hibbertia fumana</i>	Bud with elongated peduncle
13/11/2017	21	721	120	<i>Hibbertia fumana</i>	Dried flower with elongated peduncle
13/11/2017	21	722	122	<i>Hibbertia fumana</i>	Dried flower with elongated peduncle
13/11/2017	21	723	135	<i>Hibbertia fumana</i>	Flowering
13/11/2017	21	724	136	<i>Hibbertia fumana</i>	Remnant peduncle
13/11/2017	21	725	137	<i>Hibbertia puberula?</i>	Beaked buds, ID verification required
13/11/2017	21	726	138	<i>Hibbertia puberula</i>	Flowering
13/11/2017	21	727	139	<i>Hibbertia fumana</i>	No bud/flower material, poss elongated peduncle, ID verification required
13/11/2017	21	728	140	<i>Hibbertia puberula</i>	Beaked bud with no peduncle
13/11/2017	21	729	154	<i>Hibbertia puberula?</i>	No material, hairs appear simple ID verification required
13/11/2017	21	730	155	<i>Hibbertia puberula</i>	Flowering
13/11/2017	21	731	156	<i>Hibbertia puberula</i>	hairs appear simple,
13/11/2017	21	732	157	<i>Hibbertia puberula</i>	Dried flower with >10 stamens
13/11/2017	21	733	158	<i>Hibbertia fumana</i>	Bud with elongated peduncle
13/11/2017	21	734	159	<i>Hibbertia puberula</i>	Bud with no peduncle, beaked
13/11/2017	21	735	160	<i>Hibbertia puberula</i>	Bud with no peduncle, beaked

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
13/11/2017	21	736	161	<i>Hibbertia fumana</i>	No buds but remnant elongated peduncle
13/11/2017	21	737	162	<i>Hibbertia fumana</i>	No buds but remnant elongated peduncle
13/11/2017	21	738	163	<i>Hibbertia fumana</i>	No buds but remnant elongated peduncle
13/11/2017	21	739	164	<i>Hibbertia fumana</i>	Dried flower with 6 stamens
13/11/2017	21	740	165	<i>Hibbertia fumana</i>	Dried flower with 5-6 stamens
13/11/2017	21	741	166	<i>Hibbertia fumana</i>	Dried flower with 5-6 stamens
13/11/2017	21	742	167	<i>Hibbertia fumana</i>	Dried flower with elongated peduncle
13/11/2017	21	743	168	<i>Hibbertia fumana</i>	Dried flower with 5 stamens
13/11/2017	21	744	169	<i>Hibbertia fumana</i>	Dried flower with 5 stamens
13/11/2017	21	745	170	<i>Hibbertia fumana</i>	Dried flower with 5 stamens
13/11/2017	21	746	186	<i>Hibbertia fumana</i>	Remnant elongated peduncle
13/11/2017	21	747	187	<i>Hibbertia fumana</i>	Bud with elongated peduncle
13/11/2017	21	748	188	<i>Hibbertia fumana</i>	Remnant elongated peduncle
13/11/2017	21	749	189	<i>Hibbertia fumana</i>	Remnant elongated peduncle
13/11/2017	21	750	190	<i>Hibbertia fumana</i>	Flower with 5 stamens
13/11/2017	21	751	191	<i>Hibbertia fumana</i>	Remnant elongated peduncle
13/11/2017	21	752	192	<i>Hibbertia fumana</i>	Remnant elongated peduncle
13/11/2017	21	753	193	<i>Hibbertia fumana</i>	ID verification required, beginning of elongated peduncle on buds
13/11/2017	21	754	194	<i>Hibbertia fumana</i>	Very sprawling, unclear of multiple plants, elongated ped.
13/11/2017	21	755	195	<i>Hibbertia fumana</i>	Elongated peduncle on bud

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
13/11/2017	21	756	196	<i>Hibbertia fumana</i>	Elongated peduncle on bud, flower with 5 stamens
13/11/2017	21	757	197	<i>Hibbertia fumana</i>	Elongated peduncle on bud, flower with 5 stamens
13/11/2017	21	758	201	<i>Hibbertia fumana</i>	Remnant elongated peduncle
13/11/2017	21	759	202	<i>Hibbertia fumana</i>	Remnant elongated peduncle
13/11/2017	21	760	203	<i>Hibbertia fumana</i>	Remnant elongated peduncle
13/11/2017	21	761	204	<i>Hibbertia fumana?</i>	No material present, hairs unclear if stellate, ID verification required
13/11/2017	21	762	205	<i>Hibbertia fumana</i>	Dried flower with elongated peduncle
13/11/2017	21	763	212	<i>Hibbertia puberula</i>	Sprawling specimen, unclear if single or multiple beaked buds with short ped, flower with >10 stamens
13/11/2017	21	764	213	<i>Hibbertia puberula</i>	Sprawling specimen, unclear if single or multiple beaked buds with short ped, flower with >10 stamens
13/11/2017	21	765	214	<i>Hibbertia fumana</i>	Buds with start of elongated ped, ID verification required
13/11/2017	21	766	215	<i>Hibbertia fumana</i>	Buds with start of elongated ped, ID verification required
13/11/2017	21	767	242	<i>Hibbertia fumana</i>	Flower with 6 stamens
13/11/2017	21	768	243	<i>Hibbertia fumana</i>	Bud with elongated peduncle
13/11/2017	21	769	244	<i>Hibbertia fumana</i>	Bud with elongated peduncle
13/11/2017	21	770	245	<i>Hibbertia fumana</i>	Remnant elongated peduncle
13/11/2017	21	771	246	<i>Hibbertia fumana</i>	Flowers with 5-6 stamens and elongated ped
13/11/2017	21	772	247	<i>Hibbertia fumana</i>	Bud with elongated peduncle
13/11/2017	21	773	248	<i>Hibbertia fumana</i>	Flower with 5 stamens
13/11/2017	21	774	249	<i>Hibbertia fumana</i>	Bud with slightly elongated peduncle
13/11/2017	21	775	250	<i>Hibbertia fumana</i>	No bud/flower material, hairs poss stellate, ID verification required



**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
13/11/2017	21	776	251	<i>Hibbertia fumana</i>	Bud with slightly elongated peduncle, new growth nearby
13/11/2017	21	777	252	<i>Hibbertia fumana</i>	Potential remnant elongated peduncle, ID verification required
13/11/2017	21	778	253	<i>Hibbertia fumana</i>	Potential remnant elongated peduncle, ID verification required
13/11/2017	21	779	254	<i>Hibbertia puberula</i>	Cluster of buds
13/11/2017	21	780	255	<i>Hibbertia puberula</i>	Buds without ped, dried flower with >10 stamens
13/11/2017	21	781	-	<i>Hibbertia puberula</i>	Outside alignment
13/11/2017	21	782	256	<i>Hibbertia fumana</i>	No bud/flower mat, hairs unclear, poss rem along ped, ID verification required
13/11/2017	21	783	257	<i>Hibbertia fumana</i>	Flower with 5 stamens
13/11/2017	21	784	258	<i>Hibbertia fumana</i>	Flower with 5 stamens
13/11/2017	21	785	259	<i>Hibbertia fumana</i>	Flower with 5 stamens
13/11/2017	21	786	260	<i>Hibbertia puberula</i>	Buds in cluster
13/11/2017	21	787	261	<i>Hibbertia fumana</i>	Dried flower with 6 stamens
13/11/2017	21	788	262	<i>Hibbertia puberula</i>	Buds in cluster, 'beaked' flowers
13/11/2017	21	789	263	<i>Hibbertia fumana</i>	Bud with elongated peduncle
13/11/2017	21	790	264	<i>Hibbertia fumana</i>	Dried flower with 5 stamens
13/11/2017	21	791	265	<i>Hibbertia puberula</i>	hairs appear simple,
13/11/2017	21	792	266	<i>Hibbertia puberula</i>	hairs appear simple,
13/11/2017	21	793	267	<i>Hibbertia fumana</i>	Dried flower with elongated peduncle
13/11/2017	21	794	268	<i>Hibbertia fumana</i>	Remnant elongated peduncle
13/11/2017	21	795	269	<i>Hibbertia fumana</i>	Bud with start of elongated peduncle

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
13/11/2017	21	796	270	<i>Hibbertia fumana</i>	Dried flower with elongated peduncle
13/11/2017	21	797	285	<i>Hibbertia fumana</i>	Buds with elongated peduncle
14/11/2017	21	802	281	<i>Hibbertia puberula</i>	Flowers
14/11/2017	21	803	282	<i>Hibbertia puberula</i>	In bud
14/11/2017	21	804	283	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	805	284	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	806	286	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	807	287	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	808	288	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	809	289	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	810	290	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	811	291	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	812	292	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
					individual or and multiple entwined
14/11/2017	21	813	293	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	814	294	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	815	295	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	816	296	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	817	297	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	818	298	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	819	299	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	820	300	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	821	301	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	822	302	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling individual or and multiple entwined
14/11/2017	21	823	303	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
					individual or and multiple entwined
14/11/2017	21	824	304	<i>Hibbertia puberula</i>	Flowering. Highly sprawling and entwined with other veg. Difficult to differentiate if large sprawling
14/11/2017	21	825	305	<i>Hibbertia puberula</i>	individual or and multiple entwined
14/11/2017	21	826	306	<i>Hibbertia puberula</i>	Very sprawling, quite spread out
14/11/2017	21	827	307	<i>Hibbertia puberula</i>	Very sprawling, quite spread out (photo 941)
14/11/2017	21	828	308	<i>Hibbertia puberula</i>	Very sprawling, coming out of both sides of tussock
14/11/2017	21	829	309	<i>Hibbertia puberula</i>	Ph 942-944
14/11/2017	21	830	310	<i>Hibbertia puberula</i>	Flowering/buds
14/11/2017	21	832	326	<i>Hibbertia puberula</i>	Flowering/buds
14/11/2017	21	833	327	<i>Hibbertia puberula</i>	Ph 947-948
14/11/2017	21	834	328	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	835	329	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	836	-	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	837	330	<i>Hibbertia puberula</i>	Just outside clearing line
14/11/2017	21	838	331	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	839	332	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	840	333	<i>Hibbertia puberula</i>	Petals fallen off but calyx/stamens present
14/11/2017	21	841	334	<i>Hibbertia puberula</i>	Petals fallen off but calyx/stamens present
14/11/2017	21	842	335	<i>Hibbertia puberula</i>	Petals fallen off but calyx/stamens present
14/11/2017	21				In bud



**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
14/11/2017	21	843	336	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	844	-	<i>Hibbertia puberula</i>	Flowering and outside alignment
14/11/2017	21	845	337	<i>Hibbertia puberula</i>	Flowering, sprawling (possibly >1 ind)
14/11/2017	21	846	338	<i>Hibbertia puberula</i>	Flowering, very sprawling
14/11/2017	21	847	339	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	848	340	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	849	356	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	850	357	<i>Hibbertia puberula</i>	Not flowering, buds present
14/11/2017	21	851	358	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	852	359	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	853	360	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	854	361	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	855	362	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	856	363	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	857	364	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	858	365	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	859	366	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	860	367	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	861	368	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	862	369	<i>Hibbertia puberula</i>	Flowering

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
14/11/2017	21	863	370	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	864	376	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	865	377	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	866	378	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	867	-	<i>Hibbertia puberula</i>	Just outside alignment
14/11/2017	21	868	379	<i>Hibbertia puberula</i>	Very sprawled out, possible 2 ind
14/11/2017	21	869	380	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	871	381	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	871	382	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	872	391	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	873	392	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	874	393	<i>Hibbertia puberula</i>	Flowering
14/11/2017	21	876	394	<i>Hibbertia puberula</i>	Flowering
9/11/2017	23	24	26	<i>Hibbertia fumana</i>	ID required, stellate hairs on leaves axillary hair tufts Ph 25-27
9/11/2017	23	25	27	<i>Hibbertia fumana</i>	Stellate hairs on leaves axillary hair tufts Ph 28-29
9/11/2017	23	26	28	<i>Hibbertia fumana</i>	4 stamens, 1 side of 2 hairy ovaries on fallen dead flower, Ph 30-34
9/11/2017	23	27	29	<i>Hibbertia fumana</i>	Stellate hairs on leaves, axillary hair tuft
9/11/2017	23	28	36	<i>Hibbertia fumana</i>	Stellate hairs on leaves? Axillary hair tuft, 1 mature + 5 young (not tagged too small)
9/11/2017	23	29	37	<i>Hibbertia fumana</i>	Unable to tell if stellate hairs
9/11/2017	23	30	38	<i>Hibbertia fumana</i>	Slightly pedicellate 1-2mm buds, calyx hairy

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
9/11/2017	23	31	39	<i>Hibbertia fumana</i>	6 stamens, 2 hairy carpels on 1 side (fallen dead flowers), calyx has stellate hairs
9/11/2017	23	32	40	<i>Hibbertia fumana</i>	6 stamens, 2 hairy carpels on 1 side (fallen dead flowers), calyx has stellate hairs
9/11/2017	23	33	46	<i>Hibbertia fumana</i>	6 stamens, 2 hairy carpels on 1 side (fallen dead flowers), calyx has stellate hairs
9/11/2017	23	34	47	<i>Hibbertia fumana</i>	Appears to be resprouting from roots after dying off - maybe more than 1 individual? Ph37
9/11/2017	23	35	48	<i>Hibbertia fumana</i>	6 stamens, 1 side 2 hairy carpels (fallen dead flowers)
9/11/2017	23	36	49	<i>Hibbertia puberula</i>	Short peduncle, 1mm. At least 10 stamens, 1 side 2 carpels (dead fallen flowers), Ph38-40
9/11/2017	23	37	56	<i>Hibbertia fumana</i>	Dead fallen flowers, 6 stamens, 1 side 2 carpels
9/11/2017	23	38	57	<i>Hibbertia fumana</i>	Dead fallen flowers, 6 stamens, 1 side 2 carpels
9/11/2017	23	39	58	<i>Hibbertia fumana</i>	Dead fallen flowers, 6 stamens, 1 side 2 carpels
9/11/2017	23	40	59	<i>Hibbertia fumana</i>	Dead fallen flowers, 6 stamens, 1 side 2 carpels
9/11/2017	23	42	60	<i>Hibbertia fumana</i>	Stellate hair. Leaves, 1 mature + 1 too small to tag
9/11/2017	23	41	66	<i>Hibbertia fumana</i>	Stellate hairs- leaves + 1 too small to tag
9/11/2017	23	43	67	<i>Hibbertia puberula</i>	9 stamens, 1 side 2 carpels
9/11/2017	23	44	72	<i>Hibbertia fumana</i>	Stellate hairs, + 1 too small to tag
9/11/2017	23	45	73	<i>Hibbertia fumana</i>	Stellate hairs on leaves
13/11/2017	20	38	81	<i>Hibbertia</i> sp.	Recurved leaf margin
13/11/2017	20	39	82	<i>Hibbertia fumana</i>	Pedunculated flower, recurved leaf
13/11/2017	20	40	83	<i>Hibbertia fumana</i>	Flower dropped, stellate hairs on leaf apex
13/11/2017	20	41	84	<i>Hibbertia fumana</i>	Five stamens, stellate hairs
13/11/2017	20	42	85	<i>Hibbertia fumana</i>	Stellate hairs, dropped flowers, ID required

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
13/11/2017	20	43	86	<i>Hibbertia fumana</i>	Stellate hairs, dropped flowers, ID required
13/11/2017	20	44	87	<i>Hibbertia fumana</i>	Stellate hairs, dropped flowers, ID required
13/11/2017	20	45	88	<i>Hibbertia puberula</i>	Hairs, dropped, recurved margins
13/11/2017	20	46	90	<i>Hibbertia fumana</i>	Tufted at hair at base of peduncle
13/11/2017	20	47	91	<i>Hibbertia fumana</i>	Tufted at hair at base of peduncle
13/11/2017	20	48	92	<i>Hibbertia puberula</i>	Hairs not stellate, recurved margin
13/11/2017	20	49	93	<i>Hibbertia fumana</i>	5 stamens, bud not beaked
13/11/2017	20	50	94	<i>Hibbertia</i> sp.	ID required (no flowers)
13/11/2017	20	51	100	<i>Hibbertia puberula</i>	921-925 <i>H. Puberula</i> , mag stamens
13/11/2017	20	52	106	<i>Hibbertia fumana</i>	6 stamens, others sprouting around
13/11/2017	20	53	107	<i>Hibbertia fumana</i>	Has flowers, 6 stamens
13/11/2017	20	54	95	<i>Hibbertia</i> sp.	ID required (no flowers)
13/11/2017	20	55	109	<i>Hibbertia puberula</i>	Many stamens
13/11/2017	20	56	112	<i>Hibbertia fumana</i>	Stellate hairs on leaf recurved margin, no flowers
13/11/2017	20	57	113	<i>Hibbertia fumana</i>	Has flowers, 6 stamens (others sprouting)
13/11/2017	20	59	114	<i>Hibbertia fumana</i>	Stellate hairs, no flowers (others sprouting around)
13/11/2017	20	60	115	<i>Hibbertia</i> sp.	ID required (no flowers), lots sprouting around
13/11/2017	20	61	116	<i>Hibbertia</i> sp.	No flowers, bare individual
13/11/2017	20	62	117	<i>Hibbertia</i> sp.	No flowers, bare individual
13/11/2017	20	64	118	<i>Hibbertia fumana</i>	Stellate hairs of leaf recurved margin



**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
13/11/2017	20	63	141	<i>Hibbertia fumana</i>	Stellate hairs, no flowers (others sprouting around)
13/11/2017	20	65	142	<i>Hibbertia fumana</i>	Stellate hairs, no flowers (marg flowers?)
13/11/2017	20	93	206	<i>Hibbertia fumana</i>	Peduncle present, ID may be required
13/11/2017	20	94	207	<i>Hibbertia fumana</i>	Peduncle present, ID may be required
13/11/2017	20	95	208	<i>Hibbertia fumana</i>	Peduncle present, bud not beaked
13/11/2017	20	96	185	<i>Hibbertia fumana</i>	ID may be required
13/11/2017	20	97	198	<i>Hibbertia fumana</i>	Bud not beaked, peduncle present
13/11/2017	20	98	199	<i>Hibbertia fumana</i>	Peduncle present
13/11/2017	20	99	200	<i>Hibbertia fumana</i>	Peduncle present
13/11/2017	20	100	216	<i>Hibbertia</i> sp	ID required
13/11/2017	20	101	217	<i>Hibbertia fumana</i>	5-6 stamens, flower present
13/11/2017	20	102	218	<i>Hibbertia fumana</i>	6 stamens, flower present
13/11/2017	20	103	219	<i>Hibbertia fumana</i>	5 stamens, flower present
13/11/2017	20	105	210	<i>Hibbertia fumana</i>	6 stamens, flower present
13/11/2017	20	104	211	<i>Hibbertia fumana</i>	6 stamens, flower present
13/11/2017	20	106	209	<i>Hibbertia fumana</i>	ID required
13/11/2017	20	107	220	<i>Hibbertia fumana</i>	Peduncle present, ID required
13/11/2017	20	108	222	<i>Hibbertia fumana</i>	Tuffed hairs at leaf intervals
13/11/2017	20	109	223	<i>Hibbertia fumana</i>	Peduncle present
13/11/2017	20	110	224	<i>Hibbertia fumana</i>	Peduncle present

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
13/11/2017	20	111	225	<i>Hibbertia puberula</i>	Peduncle not present, no flowers
13/11/2017	20	112	226	<i>Hibbertia puberula</i>	Beaked bud
13/11/2017	20	113	227	<i>Hibbertia puberula</i>	Glabrous, sprawling habit, ID required
13/11/2017	20	114	228	<i>Hibbertia fumana</i>	Red peduncle obvious
13/11/2017	20	115	229	<i>Hibbertia puberula</i>	Glabrous, sprawling, no stellate hairs
13/11/2017	20	116	230	<i>Hibbertia puberula</i>	Glabrous, ID required
13/11/2017	20	117	231	<i>Hibbertia puberula</i>	Beaked buds
13/11/2017	20	118	232	<i>Hibbertia fumana</i>	Flowers 5 stamens
13/11/2017	20	119	233	<i>Hibbertia fumana</i>	peduncle, ID required, no flowers
13/11/2017	20	120	234	<i>Hibbertia puberula</i>	Beaked calyx, 9 stamens
13/11/2017	20	121	235	<i>Hibbertia fumana</i>	peduncle, ID required
13/11/2017	20	122	236	<i>Hibbertia fumana</i>	peduncle, ID required
13/11/2017	20	66	143	<i>Hibbertia fumana</i>	Stellate hairs on leaf recurved margin
13/11/2017	20	67	144	<i>Hibbertia puberula</i>	Hairs, no flowers, sprouting
13/11/2017	20	68	145	<i>Hibbertia</i> sp.	Many sprouting out of bare earth around
13/11/2017	20	69	146	<i>Hibbertia fumana</i>	ID may be required, stellate hairs
13/11/2017	20	70	147	<i>Hibbertia puberula</i>	Sessile atd flowers in a cluster (others sprouting around)
13/11/2017	20	71	148	<i>Hibbertia puberula</i>	Sessile, small peduncle hairless
13/11/2017	20	72	149	<i>Hibbertia fumana</i>	Stellate hairs on leaf margins (bare earth)
13/11/2017	20	73	150	<i>Hibbertia fumana</i>	Bud is not beaked, many in bare earth

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
13/11/2017	20	74	151	<i>Hibbertia</i> sp.	No flowers, ind in bare earth
13/11/2017	20	75	152	<i>Hibbertia</i> sp.	No flowers, ind in bare earth
13/11/2017	20	76	153	<i>Hibbertia fumana</i>	Stellate hairs
13/11/2017	20	77	119	<i>Hibbertia fumana</i>	Stellate hairs
13/11/2017	20	78	121	<i>Hibbertia fumana</i>	Stellate hairs
13/11/2017	20	79	171	<i>Hibbertia puberula</i>	Glabrous, sessile buds
13/11/2017	20	80	172	<i>Hibbertia</i> sp.	No flowers, ind in bare earth
13/11/2017	20	81	173	<i>Hibbertia</i> sp.	No flowers, ind in bare earth
13/11/2017	20	82	174	<i>Hibbertia</i> sp.	No flowers, ind in bare earth
13/11/2017	20	83	175	<i>Hibbertia fumana</i>	Stellate hairs. Number of small plants around 175
13/11/2017	20	84	176	<i>Hibbertia puberula</i>	Normal hairs. None stellate
13/11/2017	20	85	177	<i>Hibbertia puberula</i>	Normal hairs. None stellate
13/11/2017	20	86	178	<i>Hibbertia fumana</i>	peduncle present
13/11/2017	20	87	179	<i>Hibbertia fumana</i>	peduncle present
13/11/2017	20	88	180	<i>Hibbertia fumana</i>	Bud not beaked
13/11/2017	20	89	181	<i>Hibbertia fumana</i>	peduncle present
13/11/2017	20	90	182	<i>Hibbertia fumana</i>	peduncle present
13/11/2017	20	92	183	<i>Hibbertia fumana</i>	peduncle present
13/11/2017	20	91	184	<i>Hibbertia puberula</i>	peduncle not present
14/11/2017	20	134	273	<i>Hibbertia puberula</i>	Small leaves, many stamens, buds clumped sessile

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
14/11/2017	20	135	276	<i>Hibbertia puberula</i>	Small leaves, flowering
14/11/2017	20	136	277	<i>Hibbertia puberula</i>	Small leaves, flowering
14/11/2017	20	137	274	<i>Hibbertia puberula</i>	Small leaves, flowering
14/11/2017	20	138	275	<i>Hibbertia puberula</i>	Flowering, many stamens
14/11/2017	20	139	280	<i>Hibbertia puberula</i>	Flowering, big and sprawling
14/11/2017	20	140	278	<i>Hibbertia puberula</i>	Flowering, many stamens
14/11/2017	20	141	311	<i>Hibbertia puberula</i>	Flowering, beaked buds
14/11/2017	20	142	312	<i>Hibbertia puberula</i>	Flowering, sprawling, next to H. rip
14/11/2017	20	143	313	<i>Hibbertia puberula</i>	Flowering, big and sprawling
14/11/2017	20	144	322	<i>Hibbertia puberula</i>	Flowering, many stamens
14/11/2017	20	145	323	<i>Hibbertia puberula</i>	Flowering, many stamens
14/11/2017	20	146	325	<i>Hibbertia puberula</i>	Flowering, many stamens
14/11/2017	20	147	314	<i>Hibbertia puberula</i>	Flowering, many stamens
14/11/2017	20	148	317	<i>Hibbertia puberula</i>	Flowering, big and spreading
14/11/2017	20	149	320	<i>Hibbertia puberula</i>	Flowering, big and spreading
14/11/2017	20	150	315	<i>Hibbertia puberula</i>	Flowering - snake under log
14/11/2017	20	151	321	<i>Hibbertia puberula</i>	Flowering, big and spreading
14/11/2017	20	152	355	<i>Hibbertia puberula</i>	Flowering, big and spreading
14/11/2017	20	153	-	<i>Hibbertia puberula</i>	Flowering, just outside of line
14/11/2017	20	154	-	<i>Hibbertia puberula</i>	Flowering, just outside of line, big sprawling



**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
14/11/2017	20	155	341	<i>Hibbertia puberula</i>	Flowering, many stamens
14/11/2017	20	156	316	<i>Hibbertia puberula</i>	Many stamens
14/11/2017	20	157	342	<i>Hibbertia puberula</i>	Many stamens
14/11/2017	20	158	319	<i>Hibbertia puberula</i>	Many stamens
14/11/2017	20	160	343	<i>Hibbertia puberula</i>	Many stamens, potentially 2 plants 159
14/11/2017	20	161	344	<i>Hibbertia puberula</i>	Many stamens, small
14/11/2017	20	162	345	<i>Hibbertia puberula</i>	Many stamens, small, covered in litter
14/11/2017	20	163	346	<i>Hibbertia puberula</i>	Many stamens, small
14/11/2017	20	164	347	<i>Hibbertia puberula</i>	Many stamens, small
14/11/2017	20	165	348	<i>Hibbertia puberula</i>	Many stamens, small
14/11/2017	20	166	349	<i>Hibbertia puberula</i>	Many stamens, centre trunk, small
14/11/2017	20	167	350	<i>Hibbertia puberula</i>	No flowers, just dropped
14/11/2017	20	168	351	<i>Hibbertia puberula</i>	Flowering, small, covered in litter and plants
14/11/2017	20	169	352	<i>Hibbertia puberula</i>	Lots of stamens, healthy plant
14/11/2017	20	170	353	<i>Hibbertia puberula</i>	Lots of stamens, very little plant
14/11/2017	20	171	354	<i>Hibbertia puberula</i>	Many stamens, one-three stems, very little plant
14/11/2017	20	172	371	<i>Hibbertia puberula</i>	Many stamens, healthy plant
14/11/2017	20	173	372	<i>Hibbertia puberula</i>	Many stamens, one, two stems
14/11/2017	20	174	373	<i>Hibbertia puberula</i>	Could be two plants - difficult to differentiate
14/11/2017	20	175	375	<i>Hibbertia puberula</i>	Small plant, under <i>Melaleuca nodosa</i>

**Table 7**      **Hibbertia species – Field Identification notes**

Date	GPS	WP	Tag #	Species	Notes/Observations/Photo#
14/11/2017	20	176	374	<i>Hibbertia puberula</i>	Healthy plant under <i>Melaleuca nodosa</i>
14/11/2017	20	177	383	<i>Hibbertia puberula</i>	Sprawling, can't determine base
14/11/2017	20	178	384	<i>Hibbertia puberula</i>	Sprawling in litter
14/11/2017	20	179	385	<i>Hibbertia puberula</i>	Sprawling in litter

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*Appendix F*

Correspondence with OEH: Area of Occupany  
Methodology

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**From:** [REDACTED]  
[REDACTED] Nathan Cairney Richard Johnson  
[REDACTED] Stacy Warren Nathan Cairney Richard Johnson Steve Ryan  
**Subject:** FW: OEH Advice - SSD-6766 Moorebank MPE Stage 1 C23  
**Date:** Monday, June 4, 2018 1:56:11 PM

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[REDACTED]

Please see below response to request for advice from OEH. Can you please review the advice and advise whether the latest version of the report you have submitted to DPE is consistent with the OEH advice, including whether the impacts and offsetting requirements for the Hibbertia species have been assessed using the area of occupancy method. If not, please update the report and resubmit accordingly.

Thanks. Jacqui.

**Jacqui McLeod**

Team Leader, Infrastructure Management  
Department of Planning and Environment  
Level 22, 320 Pitt Street | Sydney NSW 2000  
GPO Box 39 | Sydney NSW 2001 | T [REDACTED]

cid:image001.jpg@01CFB7DD.BF14CAA0



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**From:** [REDACTED]  
**Sent:** Monday, 4 June 2018 10:34 AM  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** OEH Advice - SSD-6766 Moorebank MPE Stage 1 C23

Hello [REDACTED]

OEH have reviewed the *MPE Stage 1 Rail Link: Hibbertia Pre-clearance Hibbertia Survey* report (the report) dated 10 April 2018 and provide the following advice in response to your questions:

1. That the pre-clearance surveys undertaken by Cumberland Ecology between 9 and 17 November 2017 for threatened Hibbertia species and as reported in the Hibbertia Species Survey Plan are still appropriate to determine the number of individual plants of each Hibbertia species present, as required under condition C23;

*OEH considers the pre-clearance surveys within the rail link corridor appropriate for identifying the type and number of Hibbertia species. The survey intensity and survey timing are considered adequate.*

2. That the methodology used to determine the required quantum of biodiversity offset credits needed to provide an offset for the surveyed number of individual plants of each Hibbertia



species is appropriate for the calculation of the offset, post bush fire impact;

*The method used to estimate the density (and therefore the total number) of Hibbertia puberula in the proposed offset area (i.e. the proposed Wattle Grove biobank site) is considered acceptable. For Hibbertia fumana, however, the method used may have resulted in an over-estimate of the population but as the credits required to be offset (14,168) is only 25% of the (over)estimated total (56,504) this is not considered significant issue. In any case, and as advised at the 16 May meeting, OEH is amending the method of determining the offsetting requirement for these Hibbertia species from numbers of individual plants to area of occupancy. The area of occupancy is considered to be a 30 m radius around each individual, or 0.238 ha. The total area of occupancy for a population is a single polygon determined by dissolving these individual circles and then rounding up to the nearest hectare.*

3. That the required quantum of biodiversity offset credits needed to provide an offset for the surveyed number of individual plants of each Hibbertia species can be achieved; and

*Based on the information provided in the report, and subject to OEH's approval of the proposed Wattle Grove biobank site, OEH considers the requirements for offsetting impacts on each Hibbertia species can be achieved (OEH calculations indicate the proposed Wattle Grove biobank site will generate at least 3 and 5 times the required offsets for H. fumana and H. puberula, respectively). OEH recommends the report be redrafted to assess the impacts and offsetting requirements for the Hibbertia species using the area of occupancy method.*

Sincere apologies for not being able to provide this advice on Friday.

Regards

Susan Harrison  
Senior Team Leader Planning, Greater Sydney  
Regional Operations Group  
Office of Environment and Heritage  
PO Box 644  
Parramatta NSW 2124  
T: 9995 6864

[www.environment.nsw.gov.au](http://www.environment.nsw.gov.au)

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**From:** [REDACTED]  
**Sent:** Wednesday, 16 May 2018 1:28 PM  
**To:** [REDACTED] [Richard.Bonner@environment.nsw.gov.au](mailto:Richard.Bonner@environment.nsw.gov.au)  
[REDACTED] [Susan.Harrison@environment.nsw.gov.au](mailto:Susan.Harrison@environment.nsw.gov.au)  
[REDACTED] [Stacy.Warren@planning.nsw.gov.au](mailto:Stacy.Warren@planning.nsw.gov.au) [REDACTED] [Iake.Shackleton@planning.nsw.gov.au](mailto:Iake.Shackleton@planning.nsw.gov.au)  
[REDACTED] [Jonathan.Kerr@planning.nsw.gov.au](mailto:Jonathan.Kerr@planning.nsw.gov.au)  
**Subject:** SSD-6766 Moorebank MPE Stage 1 C23

Hi [REDACTED]

Thanks very much for OEH initial advice at this morning's meeting with the Proponent and from earlier discussions, regarding consideration of the requirements of condition C23.

Condition C23 requires the Hibbertia Species Survey Plan, including the survey method to be prepared in consultation with OEH, to the satisfaction of the Secretary. The survey report, dated 10 April 2018 has been submitted to DPE for consideration. DPE has undertaken an initial review of the Hibbertia Species Survey Plan. The Survey report notes that the pre-clearance surveys were conducted from 9-17 November 2017. The report also notes that additional surveys to confirm that the required quantum of biodiversity offset credits needed to provide an offset for the surveyed number of individual plants of each *Hibbertia* species can be achieved, were conducted in Wattle Grove offset area (also known as the 'Bootland' which comprises the area between the southern boundary of the terminal site and the eastern side of the approved Moorebank Avenue Bridge) in November 2017 and January 2018.

Regarding consideration of meeting the requirements for consultation with OEH, DPE notes from the survey report that no final correspondence from OE has been documented, indicating that OEH agrees with the survey method. There also appears to be an outstanding requirement for information requested by OEH for review, regarding the data obtained from previous surveys and previous survey methods. It may be that Cumberland Ecology undertook the surveys prior to the data requested by OEH being provided and without a confirmation from OEH that it was satisfied with the methodology.

Since this time the project area has been impacted by bush fire in both the biodiversity impact and offset areas. DPE is seeking your advice, in order to advise the Proponent on an update to the Hibbertia Species Survey Plan.

Could you please advise on the following:

1. That the pre-clearance surveys undertaken by Cumberland Ecology between 9 and 17 November 2017 for threatened *Hibbertia* species and as reported in the Hibbertia Species Survey Plan are still appropriate to determine the number of individual plants of each *Hibbertia* species present, as required under condition C23;
2. That the methodology used to determine the required quantum of biodiversity offset credits needed to provide an offset for the surveyed number of individual plants of each *Hibbertia* species is appropriate for the calculation of the offset, post bush fire impact;
3. That the required quantum of biodiversity offset credits needed to provide an offset for the surveyed number of individual plants of each *Hibbertia* species can be achieved; and
4. Any additional points to assist DPE's consideration of condition C23.

Your earliest advice would be greatly appreciated. Please let me know if you require anything further.

Thanks a lot.



**Jacqui McLeod**  
Team Leader, Infrastructure Management

**Subject:**

RE: Methodology for Hibbertia surveys

**From:**

**Sent:** Wednesday, June 6, 2018 4:13 PM

**Subject:** RE: Methodology for Hibbertia surveys

I have just got off the phone to John Seidel. He has confirmed that there would be no need to round up to the nearest hectare for the area of impact/conservation. The only rounding is at a credit level (since you can't acquire a part of a credit) as we suspected. He also confirmed the statement on rounding was not in the response/advice that he provided to Susan.

Regards,

[www.arcadis.com/au](http://www.arcadis.com/au)



**Subject:** RE: Methodology for Hibbertia surveys

Hi

I've looked over the email from OEH and agree with Ed's comments below.

While the updated Hibbertia Survey Plan (dated 22 May 2018) addresses the updated area of occupancy requirements (ie 30m radius around each individual), the credit calculations/credit balances will be significantly affected if the total area of occupancy has to be rounded off to the nearest hectare.

As Cumberland Ecology was not present at the meeting with DPE and OEH, I'm not sure exactly what was discussed but we will require confirmation from OEH in relation to the nearest hectare rounding off for the area of occupancy as I am also not aware of this being listed as a requirement within the Biodiversity Assessment Method 2017.

Regards,

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We are in very urgent need of this report to enable work to proceed on site, so if this can be prioritised with urgency it would be greatly appreciated. We would also appreciate a brief update on timing to close out either option above once you have had a chance to read the comments.

Regards,

NATHAN GARDNER



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Before printing this document, please consider the environment.

## **Attachment K: Other Forms and Procedures**

# Pre-Clearing Inspection Checklist

<b>Project:</b>	<b>Project No:</b>
<hr/>	<hr/>
<b>Requested By:</b>	<b>Lease / Lot Number:</b>
<hr/>	<hr/>
<b>Planned Clearing Start Date:</b>	<b>Expected Completion Date:</b>
<hr/>	<hr/>

## VEGETATION CLEARING LOCATIONS – ATTACH DRAWINGS / SKETCHES IF NECESSARY

GPS Coordinates	Location	Comments

Has the vegetation to be cleared been clearly delineated?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
All trees / vegetation to be retained identified and No-Go Areas fenced off?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No

State how identified: \_\_\_\_\_

Have habitat trees been identified and appropriately marked?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	N/A
--	--------------------------	-----	--------------------------	----	--------------------------	-----

State how identified: \_\_\_\_\_

Is there risk of weed infestation or spread?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Were any animals observed? (If Yes, relocation required)	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Are any active nests present? (If Yes, relocation required)	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
If soil disturbance is to occur, have ERSED controls been installed?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Are the proposed works covered by an existing Approval?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No

If yes, note permit number;	<b>expiry date</b>	<b>and attach a copy</b>		
<hr/>	<hr/>	<hr/>		
Have relevant workers been shown limit of clearing, advised of fauna handling procedures and any other SHE controls?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No

**Comments**

Inspection completed by:	Date:
Signature/Role	
Approval by Environmental Representative/Advisor:	Date:
<hr/>	<hr/>





# Post-Clearing Inspection Checklist

Project: \_\_\_\_\_ Project No: \_\_\_\_\_

Completed By: \_\_\_\_\_

Vegetation Clearing Start Date: \_\_\_\_\_ Completion Date: \_\_\_\_\_

**Note:** in some regions there may be additional requirements for clearing (check with the Environmental Representative for your project).

## VEGETATION CLEARING LOCATIONS – ATTACH DRAWINGS / SKETCHES IF NECESSARY

GPS Coordinates	Location	Comments

Was all clearing within the vegetation clearing limits?

<input type="checkbox"/>	Yes	<input type="checkbox"/>	No		
<input type="checkbox"/>	Yes	<input type="checkbox"/>	No		
<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	N/A
<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	N/A
<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	N/A

Were any trees marked as 'to be retained' impacted by the works?

Were any habitat trees impacted by the clearing works?

Were non-habitat trees removed before habitat trees?

Were any fauna, nests or other fauna features impacted by the clearing works?

Were any animals shocked, injured or killed as a result of the clearing works? If Yes, what action was taken?

<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
--------------------------	-----	--------------------------	----

Area Cleared, Topsoil Volumes and Locations Surveyed

<input type="checkbox"/>	Yes	<input type="checkbox"/>	No		
<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	N/A

Was the *Process: Fauna Management* followed for any fauna impacted by the works?

Comments:

Inspection completed by:

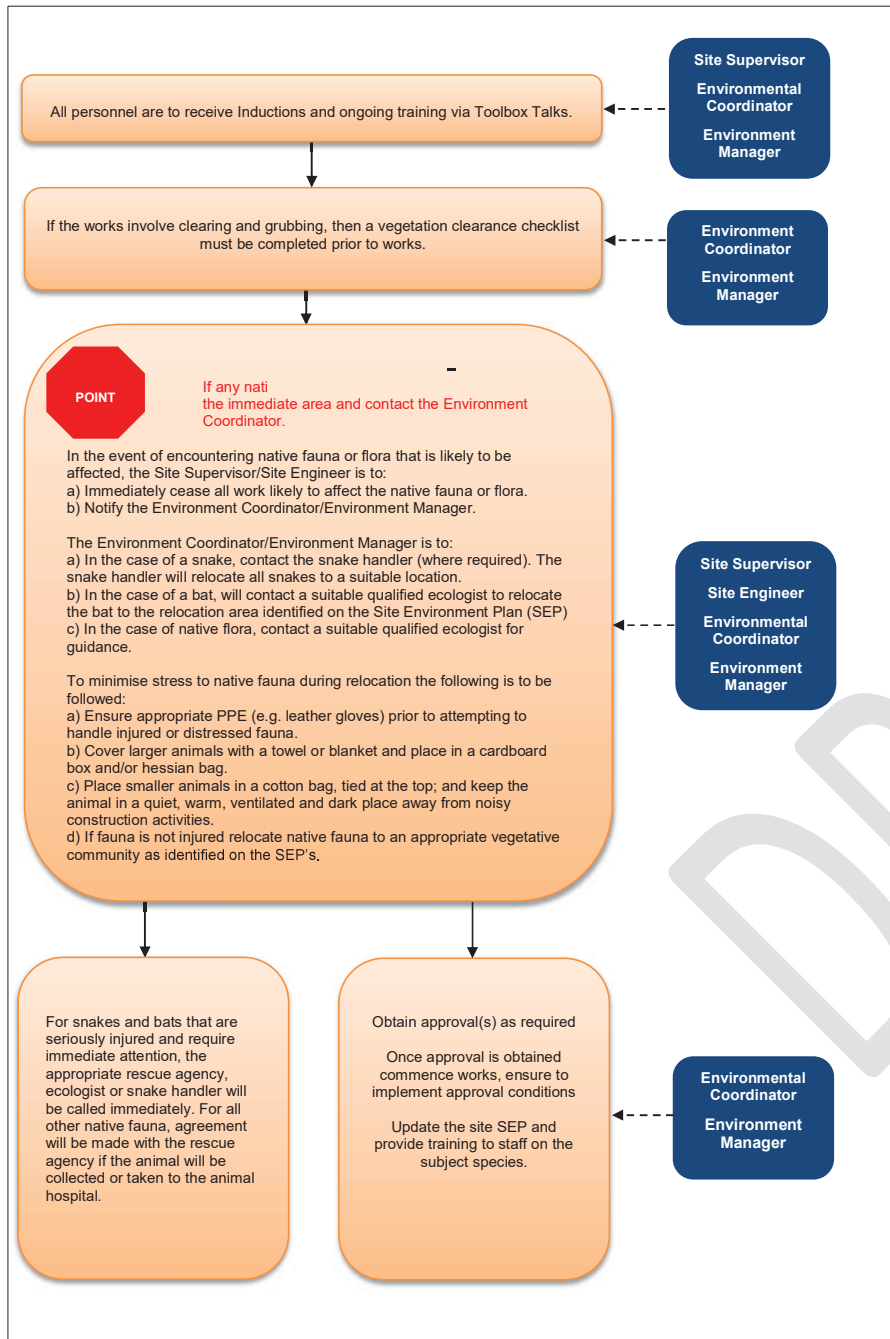
Date:

Signature/Role

Approval by Environmental Representative/Advisor:

Date:





### Rescue Service Contact

WIRES (Wildlife Information, Rescue and Education Service)	1300 094 737
RSPCA (Emergency Line)	02 9770 7556
Liverpool Veterinary Hospital	02 9602 6015
Casula Veterinary Hospital	02 9602 9863
Baulkham Hills Animal Referral Hospital (24 hour emergency Service)	02 9639 7744
Sydney Snake Catcher	1300 599 938

### Handling Procedure

- If the animal cannot be handled (i.e. venomous reptile or bats), the exact location of the animal is to be recorded and provided to the snake handler or suitable qualified ecologist (for bats). All personnel and/or subcontractors are to be excluded from the vicinity. Once the snake handler or ecologist arrives on site they are responsible for the fauna. Any decisions regarding the care of the animal will be made by them.
- If the animal does not require immediate attention, as determined by the Environment Coordinator or Environment Manager in consultation with the Ecologist and/or fauna specialist (where required), the rescue agency will be called to collect any animals requiring attention.
- In the event the rescue service cannot be contacted, the Environment Coordinator or Environment Manager will deliver the injured/captured animal (other than snakes or bats) to the agency as soon as practically possible.









### Release Procedure (native fauna other than snakes or bats)

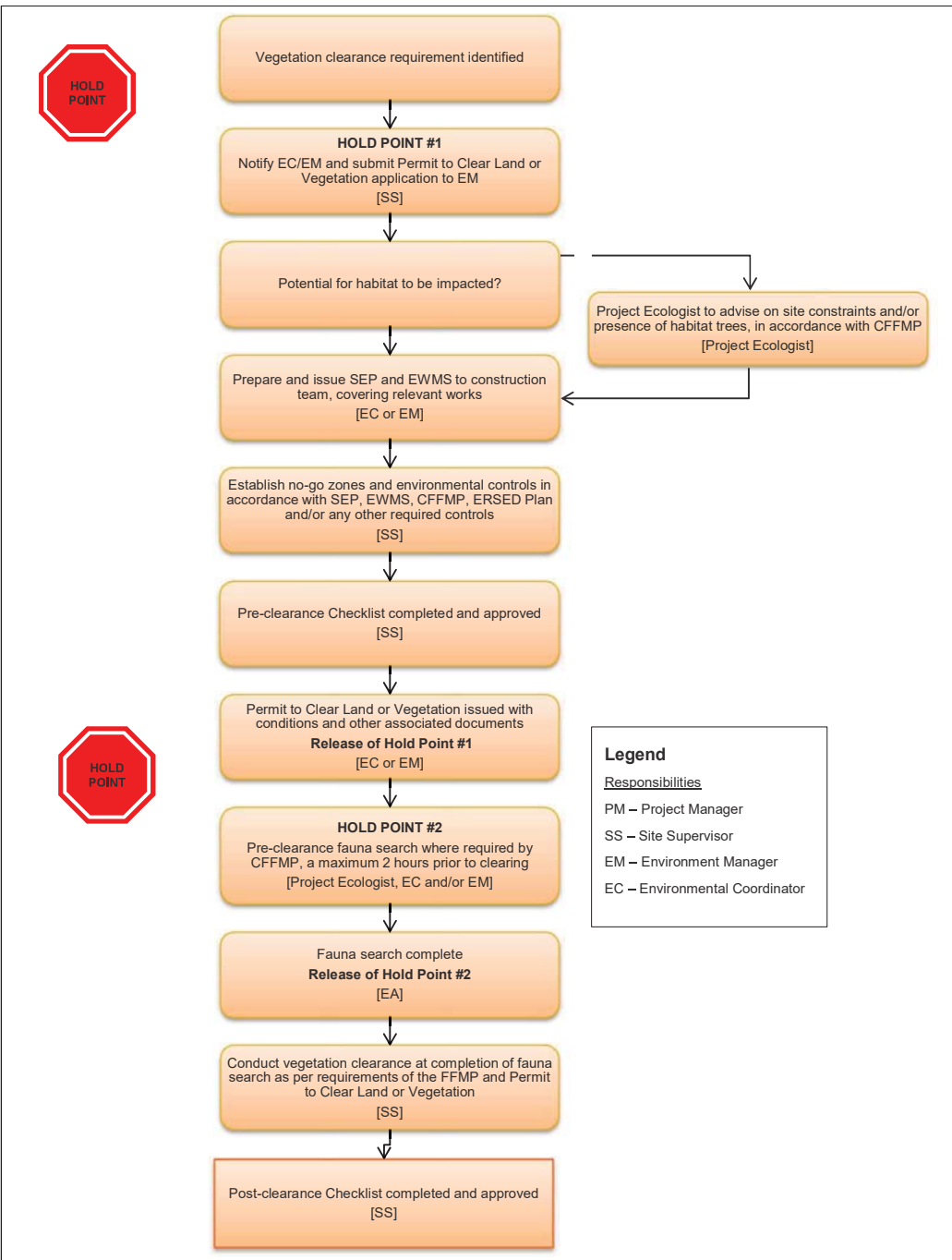
If the animal is not injured, the Environment Coordinator or Environment Manager in consultation with the ecologist (where required) may release the fauna into a suitable area in accordance with the following procedures:

- The Environmental Coordinator or Environment Manager in consultation with the ecologist (where required) is to be responsible for undertaking the release
- If the species is nocturnal, release would be carried out at dusk

### Reporting

Records of any fauna handling will be entered into Lotus Notes.

	Cumberland Plain Land Snail	TSC Act - Endangered		Eastern Freetail-Bat	TSC Act - Vulnerable
	Grey-headed Flying Fox	TSC Act – Endangered EPBC Act - Vulnerable		Eastern Bent-wing Bat	TSC Act - Vulnerable
	Yellow-bellied Sheathtail Bat	TSC Act - Vulnerable		Greater Broad-nosed Bat	TSC Act - Vulnerable
	Green and Gold Bell Frog	TSC Act - Vulnerable		Red Bellied Black Snake	-



## 1. Introduction

### 1.1 Objectives

To ensure all vegetation clearing and grubbing required for the Project is conducted in accordance with Project approvals, is minimised within the approved areas and minimises impacts on biodiversity and the surrounding environment.

### 1.2 Training

- All personnel to receive Environmental Induction and toolbox talks

## 2. Vegetation clearance procedure

### 2.1 Pre-Clearing

- When an area is identified to require vegetation clearing, the SS is to notify EC / EM and prepare and submit a **Permit to Clear Land or Vegetation application** to the EM.
- EC / EM to prepare a **Site Environmental Plan (SEP)** and **Environmental Work Method Statement (EWMS)** that outlines the environmental risks and associated control measures, as well as the
- As part of the Permit to Clear Land or Vegetation, the SS, in conjunction with the EC/EM, prepares a **Pre-Clearing Inspection Checklist (PCIC)** in accordance with the Construction Flora and Fauna Management Plan (CFFMP). The pre-clearing inspection will include the identification of weeds, with the Weed Management Procedure from the Weed Management Strategy followed as required. The pre-clearing inspection will also identify the location of habitat trees or threatened flora.
- Clearance near waterways is to be avoided as much as practicable. All existing trees and other vegetation must be retained within 15 metres of waterways and drainage lines until immediately before construction commences in the area.
- No-go Zones must be established, fenced or flagged, and sign posted prior to the commencement of clearing. All hollow bearing and habitat trees shall be either fully fenced off or flagged and spray painted/sign-posted with an identification number.
- The progressive erosion and sediment control plan (PESCP) must be in place prior to clearing.
- Once all environmental controls are in place, the Site Supervisor completes the Pre-clearance Inspection Checklist and submits to the EM for review/approval.
- Permit to Clear Land or Vegetation issued by EM with Pre-Clearing Inspection Checklist.

### 2.2 During Clearing

- Clearing is to be in accordance with the requirements of the Permit to Clear Land or Vegetation, Pre-Clearing Inspection Checklist, SEP, EWMS and CFFMP (as applicable).
- A pre-clearance search for fauna is to be undertaken by an ecologist or qualified and experienced fauna handler. Fauna searches should occur no more than two hours prior to the commencement of clearing and the time allocated to searching should be commensurate with the likelihood of finding fauna and the complexity of habitat features. Searches should include checks for signs of fauna such as fresh scats, scratches and remains of prey.
- A pre-clearance search of structures, e.g. bridges and culvert, will be completed for microbats in accordance with the requirements of the Pre-Clearing Inspection Checklist and CFFMP.
- The fauna handler or ecologist must be present during clearing and is to direct clearing in a manner that encourages and allows fauna to safely flee the clearing area. Where animals are unable to flee as a result of injury or otherwise, they will be captured and placed in adjacent areas of analogous habitat in accordance with the Fauna Spotter / Catcher procedure. Injured animals will also be cared for in accordance with this procedure.
- Trees within 15 metres of watercourses should be felled manually wherever possible. Where practicable, cut vegetation low to ground and leave roots and ground vegetation cover in place near watercourses to minimise erosion impacts.
- Pruning shall be in accordance with AS 4373 – Pruning of Amenity Trees. It should be carried out by a qualified arborist using only the appropriate tools (e.g. loppers, chainsaw or vehicle mounted pole saw).

### 2.3 Post-Clearing

- Post-Clearing Inspection Checklist to be completed at completion of clearing
- Stabilise all disturbed areas with revegetation or other material immediately to prevent erosion.
- Any damage to vegetation to be retained must be reported to the Site Supervisor or EA immediately and rectified with the advice of an ecologist or arborist.
- Holes remaining after tree removal must be backfilled and vegetated. Backfill material must prevent the infiltration and ponding of water and be compacted to at least the relative compaction of adjacent ground



## Attachments

### Attachment L: Threatened Dragonfly Species Survey Plan

# Moorebank Precinct West

## Threatened Dragonfly Species Survey Plan Report



**SIMTA**

**SYDNEY INTERMODAL TERMINAL ALLIANCE**

**Part 4, Division 4.1, State Significant  
Development**

# TACTICAL GROUP MOOREBANK PRECINCT WEST

## Threatened Dragonfly Species Survey Plan Report

**Author** Adam Costenoble

**Checker** Kate Carroll

**Approver** Ketan Patel

**Report No** 001

**Date** 26/09/2016

**Revision Text** Final

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## REVISIONS

Revision	Date	Description	Prepared by	Approved by
001	26/09/16	For submission to DPI Fisheries	Adam Costenoble	Ketan Patel

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## EXECUTIVE SUMMARY

This report presents the findings of a threatened dragonfly habitat assessment that Arcadis ecologists conducted in September 2016. This assessment was undertaken in accordance with Condition of Approval D19 (SSD\_5066) for the Moorebank Precinct West (MPW) project in Moorebank, NSW, which is situated directly adjacent to the Georges River. Two threatened dragonflies, Adam's Emerald Dragonfly and Sydney Hawk Dragonfly, were the target species for this assessment. A desktop review was completed and approved by DPI Fisheries in August 2016 as part of the Threatened Dragonfly Species Survey Plan.

Two Arcadis ecologists traversed the survey area by kayak in order to carry out the habitat assessment along the banks of the river. The assessment involved a systematic visual search for habitat features that could accommodate the larval stages of the targeted species throughout the survey area.

The character of the Georges River within the survey area is markedly different from known habitat for the targeted dragonfly species. No habitats for either Adam's Emerald Dragonfly or Sydney Hawk Dragonfly were detected in the survey area. It is thus highly unlikely that threatened dragonflies occur in the survey area and therefore no impact to these species is expected to occur as a consequence of the MPW project.

Considering the absence of suitable habitat within the survey area, it is the recommendation of this assessment that no further investigation or targeted exuviae surveys are required.

# 1 INTRODUCTION

## 1.1 Project Overview

On the 3 June 2016 Concept Plan Approval (SSD 5066) was granted, under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), to develop the Moorebank Precinct West Project (MPW Project) on the western side of Moorebank Avenue, Moorebank, in south-western Sydney (the MPW site).

The MPW Project involves the development of intermodal freight terminal facilities (IMT), linked to Port Botany, the interstate and intrastate freight rail network. The MPW Project includes associated commercial infrastructure (i.e. warehousing), a rail link connecting the MPW site to the Southern Sydney Freight Line (SSFL), and a road entry and exit point from Moorebank Avenue.

The MPW site is generally bounded by the Georges River to the west, Moorebank Avenue to the east, the East Hills Railway Line to the south and the M5 Motorway to the north (Figure 1).



Figure 1 Project boundary.

## 1.2 Purpose of this report

This report has been prepared with due regard for condition D19 of the Moorebank Precinct West (MPW) Concept Plan Approval (SSD\_5066) which states:

*The Applicant shall prepare and implement a 'Threatened Dragonfly Species Survey Plan' to determine the presence or absence of threatened dragonfly species listed under the Fisheries Management Act 1994 on the Georges River, adjacent to the development site. The plan, including survey methodology, shall be prepared in consultation with DPI Fisheries prior to the commencement of Early Works.*

*On implementing the plan, the survey results are to be forwarded onto DPI Fisheries. Should threatened dragonfly species be found at this site, DPI Fisheries should be contacted to agree on possible mitigation measures to avoid impacts in accordance with NSW DPI Policy and Guidelines for Fish Habitat Conservation and Management (2013).*

The Threatened Dragonfly Species Survey Plan (TSSSP) must be prepared prior to the commencement of Early Works which is defined as follows:

*"the demolition of buildings, including services termination and diversion; rehabilitation of the excavation/ earthmoving training area; remediation of contaminated land; removal of underground storage tanks; heritage impact remediation works; and the establishment of construction facilities and access, including site security."*

A TDSSP was prepared by Arcadis and accepted by DPI Fisheries on 11 August 2016. This report presents the findings of the habitat assessment carried out in accordance with the TDSSP during September 2016.

## 1.3 Aims of this Report

The overarching objective of the Threatened Dragonfly Species Survey Plan and this associated report is to assess the presence of threatened dragonflies or their habitat along the Georges River adjacent to the Project site. Two threatened dragonfly species are addressed in this report, Sydney Hawk Dragonfly *Austrocordulia leonardi* and Adams Emerald Dragonfly *Archaeophya adamsi*.

The commitment was made in the TDSSP to carry out a field-based habitat assessment of the Georges River adjacent to the Project site to determine the likelihood that threatened dragonflies occur within the site. The aim of this report is to present the findings of that habitat assessment to DPI Fisheries and to make recommendations regarding further investigations.

## 1.4 Consultation

The TDSSP was produced in consultation with DPI Fisheries. This report continues that process and provides further opportunity for consultation regarding further actions required. The chronology of correspondence to date is as follows:

- 13/07/16 – Arcadis provided initial overview of methodology to DPI Fisheries in order to identify survey requirements,
- 21/07/16 – DPI Fisheries respond to initial methodology and outline specific expectations for TDSSP,
- 09/08/16 – Arcadis submit TDSSP for DPI review,
- 11/08/16 – DPI Fisheries accept TDSSP with one minor amendment,
- 26/09/16 – Arcadis submit final updated TDSSP to DPI Fisheries with TDSSP Report – Habitat Assessment (this report).

## 2 METHODOLOGY

The proposed methodology for the Dragonfly surveys as per the TDSSP involves a three-stage process:

1. Desktop assessment
2. Habitat assessment with report (this report)
3. Targeted dragonfly exuviae searches

The first two stages are detailed below; Stage 3 was not undertaken as habitat was not identified (see section 5).

### 2.1 Desktop Assessment

The desktop assessment involves a detailed review of the scientific literature, government publications and all available database records for each of the target species. This review has been collated in the form of species profiles (see section 3) that have been used to determine the ecology and habitat requirements of the targeted species. This information informs the habitat assessment and targeted searches within the study area. Previous records of the species across the Sydney Basin have been mapped in relation to the survey area (Figure 3).

### 2.2 Habitat Assessment

#### 2.2.1 Survey area

The survey area comprises a 3.7 kilometre reach of the Georges River between the crossings of Cambridge Avenue and the M5 Southwestern Motorway at Moorebank, NSW (Figure 2). This area includes the 2.7 kilometre stretch of river adjacent to the MPW site plus 500 metres up and downstream of the MPW site.

The survey focused on edge habitats adjacent to the MPW site on the eastern bank of the river but also included any mid-stream habitats (such as riffles or pools) and also comparison to the western bank along the full length of the survey area.

#### 2.2.2 Reference site comparison

The specific qualities of known habitat sites were identified for the targeted species during the desktop review of the scientific literature. Prior to the habitat assessment in the survey area the ecology team visited two of these known habitat sites to gather photographs as a visual reference of quality habitat features that sustain the targeted species. These two sites included:

- Freres Crossing on the Georges River near Campbelltown (34.06137°S, 150.879274°E)
- Floods Creek, Somersby Falls within Brisbane Waters National Park on the Central Coast (33.401363°S, 151.267845°E).

Features that matched the qualities associated with each species were photographed to allow visual comparison of the features within the study area.



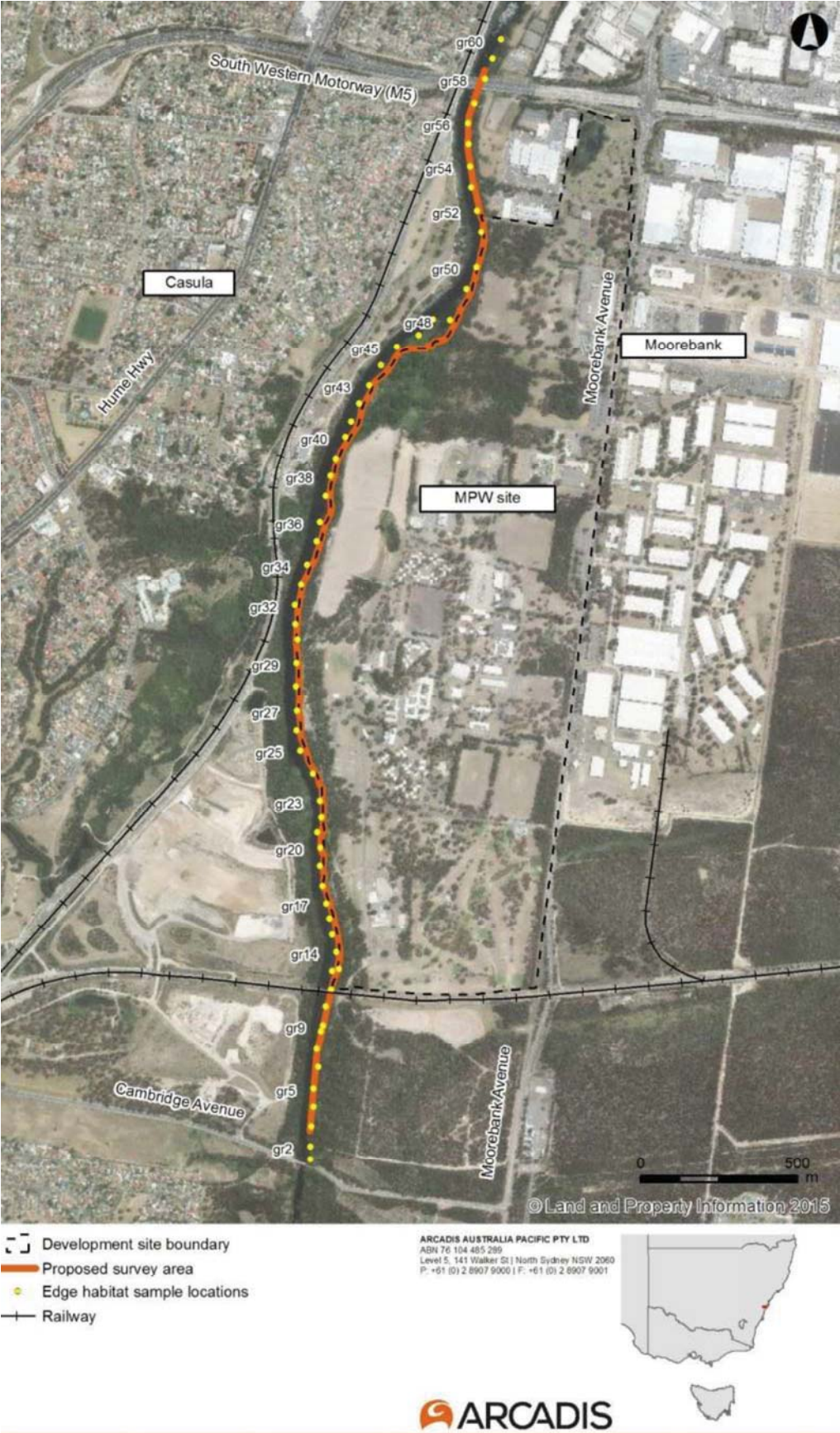


Figure 2 Survey area and actual habitat sample locations. The orange line indicates the survey area as proposed in the TDSSP.

## 2.2.3 Habitat features

The habitat assessment involved a systematic visual search for habitat features that are known to accommodate the larval stages of the targeted species throughout the survey area (as listed in Table 1). Larval habitats were targeted because it is in this development stage that the species spends the majority of its life-cycle and it is these habitats that the adults return to for breeding. These habitat features have been determined based on the results of the comprehensive literature review (Section 3) and through consultation with DPI Fisheries.

Table 1 Habitat features that were searched for within the survey area

Species	Habitat features
Sydney Hawk Dragonfly <i>Austrocordulia leonardi</i>	<ul style="list-style-type: none"> <li>• Deep riverine pools with cool water</li> <li>• Permanently flowing rocky river with steep sides that provide shady rest areas</li> <li>• Rocks for larvae to shelter beneath</li> <li>• Representative habitats depicted in Figure 10 and Figure 11</li> </ul>
Adam's Emerald Dragonfly <i>Archaeophya adamsi</i>	<ul style="list-style-type: none"> <li>• Small to moderate sized creeks with gravel or sandy bottom</li> <li>• Narrow shaded riffle zones with moss and abundant riparian vegetation</li> <li>• Canopy cover</li> <li>• Representative habitats depicted in section 4.2</li> </ul>

## 2.2.4 Survey effort

The survey area was traversed by two Arcadis ecologists, Laura Hoffman and Adam Costenoble, using kayaks in order to facilitate efficient access to mid-stream and edge habitats along the eastern bank of Georges River. The bank of this section of the Georges River is steep and heavily vegetated in parts and this access method ensured uninhibited access to the survey area. This assessment was carried out on 13 September 2016 in accordance with the commitments made in the TDSSP. Conditions on the day were dry, warm and mostly overcast.

A systematic survey approach was employed to ensure thorough assessment of the survey area.

Edge habitats were sampled where the qualities of the edge habitat changed, or at 50-100 metre intervals along stretches where the edge habitat remained consistent. In total, 60 sample points were taken along the 3.7 kilometre eastern bank of the survey area. Ten metres of bank habitat along the water's edge were considered at each sample point location. The survey area was traversed from south to north starting with GR01 at the most upstream position near Cambridge Avenue to GR60 just north of the South-Western Motorway bridge, (see Figure 2 for sample density and actual sample points).

A change in edge habitat was characterised by variation of the following features:

- bank slope (flat to steep or undercut)
- riparian vegetation structure (wetland, paddock, forest)
- change in degree of overshadowing from riparian vegetation
- noticeable change in substrate material (mud/silt to gravel, sand or rock)
- change in river flow velocity (straight channel becomes beach-like embayment)
- change in turbidity (areas where water visibility changes)

- bend in the river
- creek junction
- other visible changes (to be determined on site)

No mid-stream habitats such as riffles or pools were detected, thus the survey consisted primarily of edge habitat assessment.

### **2.2.5 Data collection**

Each survey location was marked by GPS and mapped (see Figure 2). A photograph was taken at each sample point location. At each survey point a datasheet pro-forma was filled out to thoroughly consider the habitat features at each point (see Appendix A). This pro-forma has been selectively adapted from the AUSRIVAS Physical Assessment Protocol to target abiotic and biotic river features that relate to the targeted threatened dragonfly species.

Photographs and a general overview of the river conditions was also carried out in the upper (GR01-GR20), mid (GR21-GR40) and lower sections (GR41-GR60) of the survey area.

### **2.2.6 Habitat assessment reporting**

This document forms the TDSSP Report that was proposed in section 3.2.6 of the TDSSP. Its purpose is to communicate the results of the field habitat assessment of the study area and to make recommendations regarding the need for further investigations, if required. See section 4 and section 5 for the results of the habitat assessment of the study area.

### 3 DESKTOP ASSESSMENT – THREATENED DRAGONFLIES SPECIES PROFILES

There are three dragonfly species currently listed under the *Fisheries Management Act 1994* (FM Act):

- Adams Emerald Dragonfly (*Archaeophya adamsi*) - Endangered
- Sydney Hawk Dragonfly (*Austrocordulia leonardi*) - Endangered
- Alpine Redspot Dragonfly (*Austropetalia tonyana*) – Vulnerable

These species are not listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Both Adams Emerald Dragonfly and the Sydney Hawk Dragonfly are known from the Sydney basin with the closest historic records of the species occurring within 35km and 12.5km from the Project site respectively. The Alpine Redspot Dragonfly is only known to occur at altitudes above 600 metres and is thus excluded from this survey plan as the Project site is less than 10m above sea level. An additional dragonfly species, the Giant Dragonfly (*Petalura gigantea*), is listed under the TSC Act but is not included in this study since it does not occur in the Sydney metropolitan area.

The target species are the rarest in Australia. These species are sparsely distributed within known habitat and little is known about their biology. A comprehensive review on the available background information including species descriptions, habitat preferences and distribution (Figure 3) has been collected through desktop literature review and database searches. This review is presented in the remainder of this section.



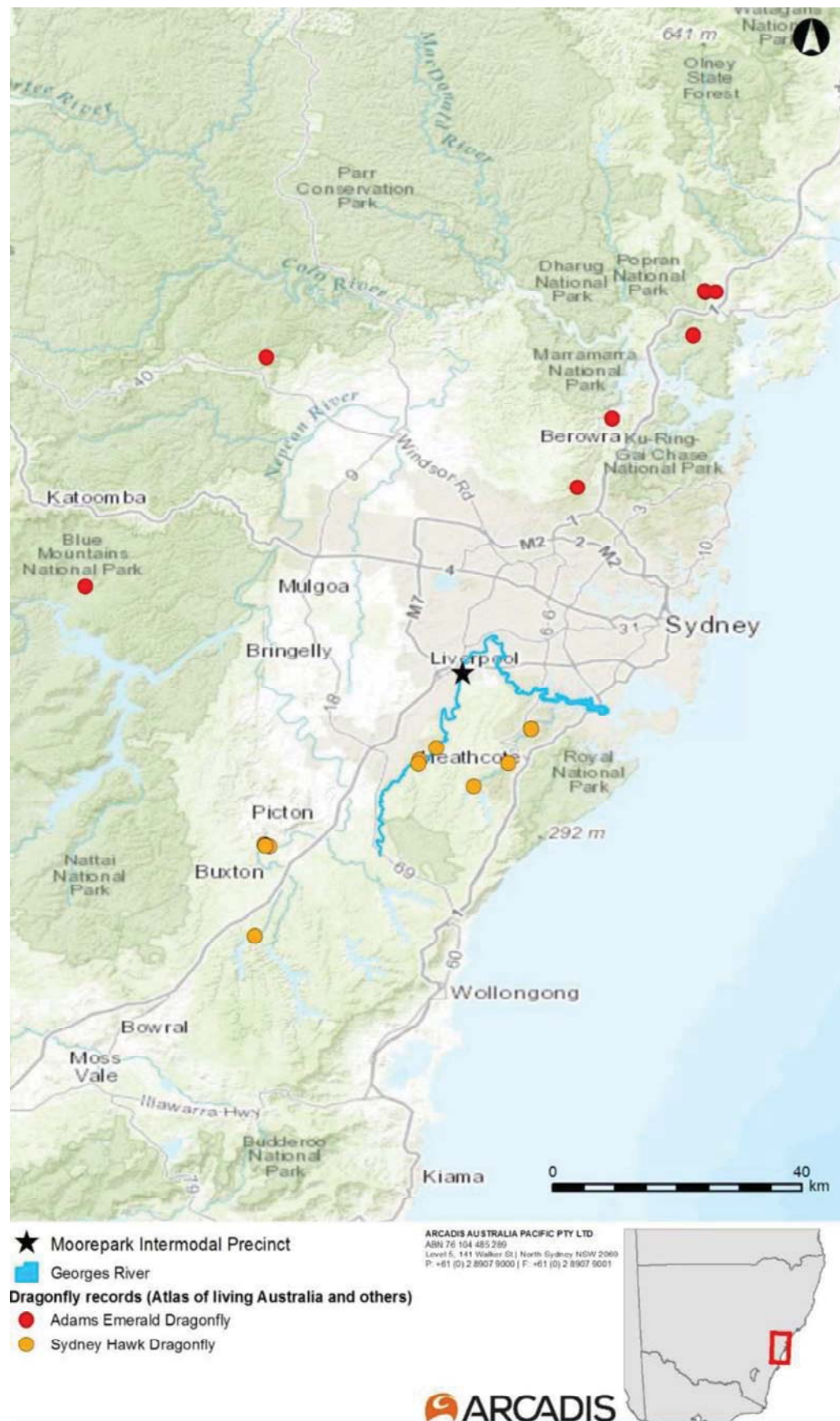


Figure 3 - Records of threatened dragonflies across the Sydney Basin as sourced from the Atlas of Living Australia database, Theischinger et al. (2009) and Theischinger et al. (2011).

### 3.1 Adam's Emerald Dragonfly - *Archaeophya adamsi*

#### 3.1.1 Description

A member of the Gomphomacromiidae family (formerly part of Corduliidae).

The Adam's Emerald Dragonfly is a moderately large, robust Dragonfly. Larvae grow to about 23mm in length and have a large two-lobed frontal plate on the head, which distinguishes them from any other species found in NSW (Figure 6). The adults have a brown-black body with yellow markings, and a slight green or bluish metallic reflection on some parts (Figure 4, Figure 5 & Figure 7). The abdomen length is around 46 mm and wingspan around 75 mm (DPI Fisheries 2013).



Figure 4 *Archaeophya adamsi*, teneral male and exuvia. Photo: G. Theischinger.



Figure 5 *Archaeophya adamsi*, female, dorsal view. Photo: L. Müller



Figure 6 *Archaeophya adamsi*, larva. Photo: S. Jacobs



Figure 7 *Archaeophya adamsi*, female, lateral view. Photo: L. Müller

#### 3.1.2 Distribution

Adam's Emerald Dragonfly is one of Australia's rarest dragonflies. Only a small number of adults have ever been collected, and the species is only known from a few sites in the greater Sydney region. These sites include a number of creeks near Galston Gorge at Hornsby, Somersby Falls in Brisbane Waters National Park on the Central Coast and a few creeks in the Blue Mountains and Wollemi National Parks (Figure 3).

Despite there being limited records for the species the potential distribution includes all of the Sydney basin and thus includes the Project site (Figure 8).

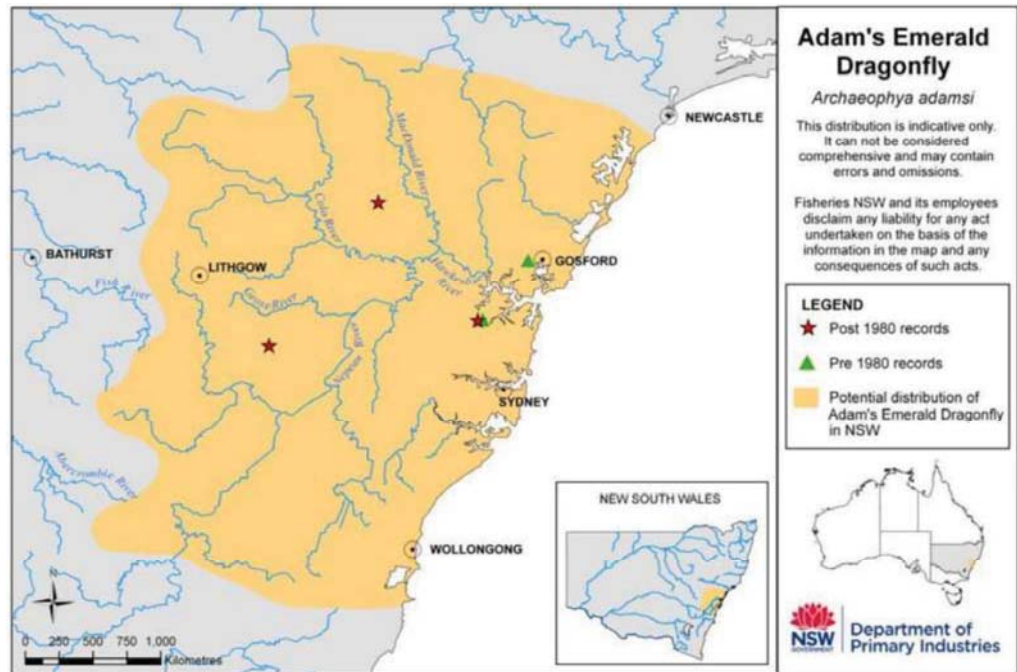


Figure 8 Potential distribution of *Archaeophya adamsi* (Fisheries NSW)

### 3.1.3 Habitat

Adam's Emerald Dragonfly larvae have been found in narrow, shaded riffle zones with moss and abundant riparian vegetation (often closed canopy) in small to moderate sized creeks with gravel or sandy bottoms (DPI Fisheries 2013). Adults can be found on rocks or in litter among the stream margins or in riffle situations (Theischinger and Hawking, 2006). The majority of sightings for this species have occurred in undisturbed, well-vegetated habitats which are mostly located in national parks or reserves (Theischinger *et al.*, 2011).

### 3.1.4 Life history

Adam's Emerald Dragonfly may live up to 7 years and undergo various moults as a larvae before metamorphosing into a flying adult. Adult dragonflies generally fly away from the water to mature before returning to breed. Males fly actively at breeding sites and often guard a territory. Females probably lay their eggs into the water. The lifespan of an adult is limited to a few months duration.

This species has a low natural rate of recruitment and limited dispersal abilities.

## 3.2 Sydney Hawk Dragonfly - *Austrocordulia leonardi*

### 3.2.1 Description

A member of the Austrocorduliidae family (formerly part of the Corduliidae family).

The Sydney Hawk Dragonfly is a black and yellow dragonfly with clear wings spanning 60-70mm, and with an adult abdomen length of 35-40mm (Figure 9). The aquatic larvae have a body length of 22-24mm and are distinguished from the similar Eastern Hawk dragonfly, *Austrocordulia refracta*, by a uniformly arched abdomen and distinctive abdominal colour pattern (Figure 12) (DPI Fisheries 2016).





Figure 9 *A. leonardi*. Photo: G. Theischinger



Figure 10 *A. leonardi* habitat. Photo: A. Bruce



Figure 11 *A. leonardi* habitat. Photo: G. Theischinger



Figure 12 Final instar exuvia, dorsal view of *A. leonardi*. Photo: G. Theischinger

### 3.2.2 Distribution

Until recently the known distribution of Sydney Hawk Dragonfly has been extremely limited, being found in only three locations in a small area south of Sydney, from Audley to Picton including the Hawkesbury-Nepean, Georges River and Port Hacking drainages. First discovered in the Woronora River and Kangaroo Creek, south of Sydney it was later recorded from the Nepean River, Maldon Bridge near Wilton. Recent sightings have shown that the species also occurs beyond the Sydney Basin north of the Hunter River (Theischinger *et al.* 2013). Recent habitat searches within the Sydney Basin have found additional sightings of the species on the upper reaches of the Georges River in Heathcote National Park near Campbelltown approximately 18km upstream from the Project site (Theischinger *et al.* 2009) (Figure 3).

Despite there being limited records for the species the potential distribution includes south and southwest Sydney with the Project site situated on the northern edge of this potential range within the Sydney Basin. Intensive surveys by Theischinger and colleagues have failed to detect the presence of any of the life stages of Sydney Hawk Dragonfly in previously known habitats along the Woronora River (DPI Fisheries 2005); however, the species persists in the Kangaroo River within the Royal National Park (Theischinger, 2009).



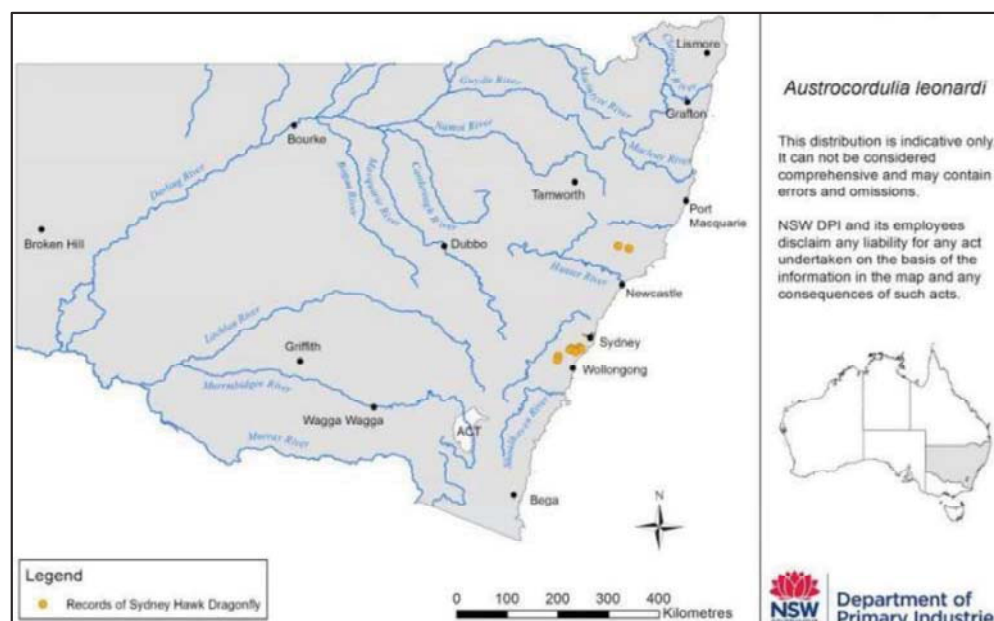


Figure 13 Potential distribution of *Austrocordulia leonardi* in Sydney Basin (DPI Fisheries 2016)

### 3.2.3 Habitat

This species has specific habitat requirements, including deep pools in permanently flowing rocky rivers with steep sides that provide shady resting areas. All specimens collected came from deep riverine pools with cooler water (along the Woronora River, Kangaroo Creek and Nepean River). The site of first discovery of the species is a deep pool above the weir at Heathcote in the Woronora River. Larvae can be found under rocks where they may coexist with the similar Eastern Hawk dragonfly *Austrocordulia refracta*. Representative images of potential habitat are depicted in Figure 10 and Figure 11 above.

### 3.2.4 Life history

*Austrocordulia leonardi* is a rare species. While many exuviae (the moulted shell of the larvae from which the adults emerge) have been found, only 11 adult specimens have been discovered. Most of the life cycle of this species is spent as an aquatic larva, while adults are present for only a few weeks. It is strictly a diurnal dragonfly that requires open, sunlit space (DPI Fisheries 2016).

## 4 REFERENCE SITE COMPARISON

### 4.1 Freres Crossing, Freres Crossing Reserve

Freres Crossing was visited as a comparison site of known habitat for the Sydney Hawk Dragonfly (*Austrocordulia leonardi*). *Austrocordulia leonardi* were recorded during surveys in the Georges River at Freres Crossing in February 2009 (Theischinger *et al.* 2009). The site is situated approximately 18km upstream from the survey area and was chosen for comparison because of its ease of access and its proximity to the survey area.

The Georges River at this location borders the small suburb of Kentlyn (near Campbelltown) to the west and Holsworthy Army Reserve on the east. The river at this location is characterised as an upland mountain stream in a river valley. The river at this location is approximately 40 above sea level (ASL) and is surrounded by 80-90 metre ridgelines and naturally vegetated woodland slopes. The western slope is well vegetated up to Kentlyn on the ridge and a large expanse of bushland continues on the east throughout the army reserve.

Freres Crossing itself is the site of the remains of a historic bridge on a road that once formed part of the 1917 highway connecting Campbelltown and Newcastle. A rock platform at this location forms somewhat of a natural weir at a narrowing of the river (Figure 14) which has resulted in a number of deep wide pools either side of it. These pools, which have a gravel/rock substrate and steep shaded sides, are characteristic of habitat for *A. leonardi* (Figure 15 and Figure 16).

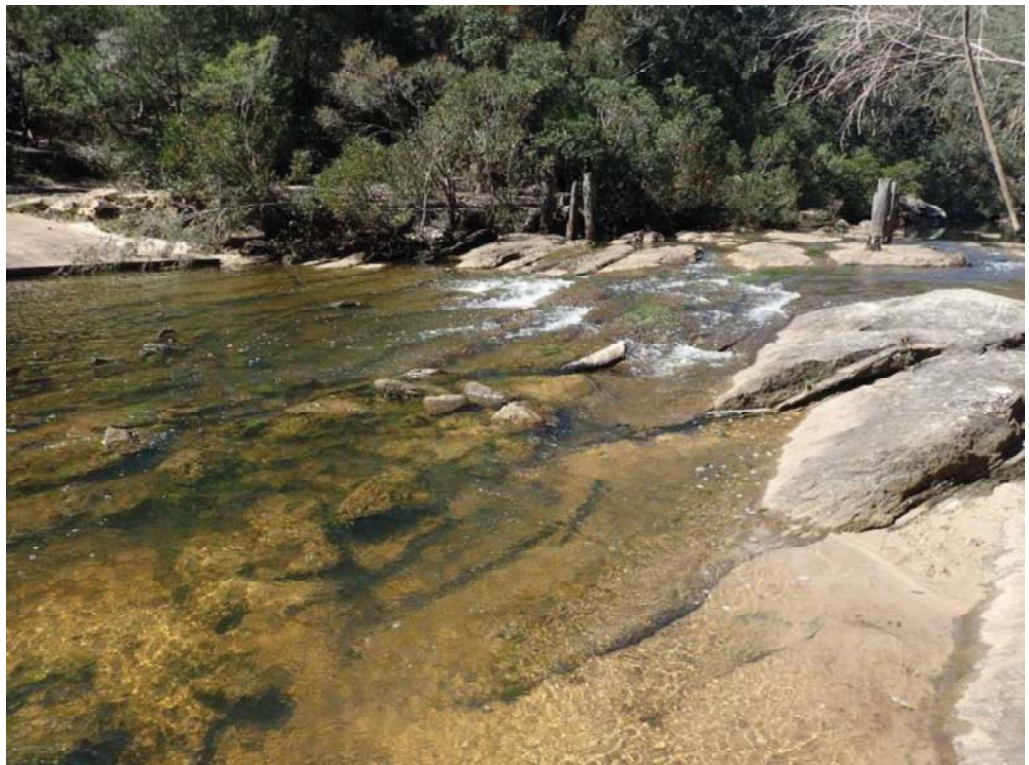
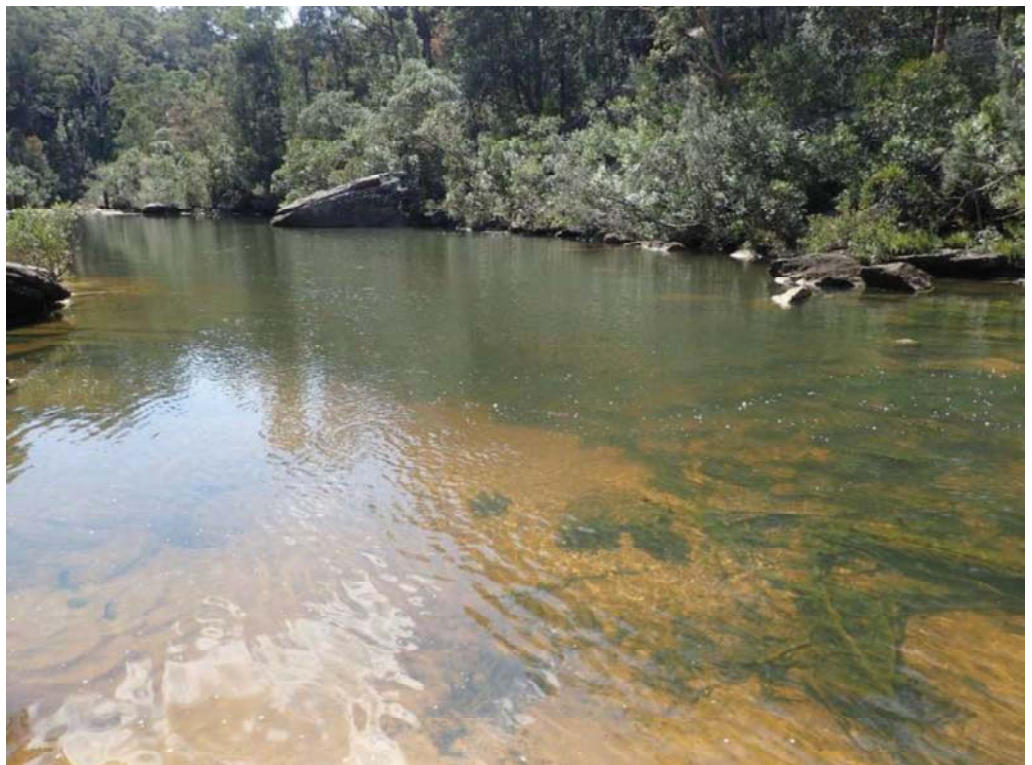


Figure 14 Freres Crossing



*Figure 15 Deep pool with steep shaded sides and rocky bottom just upstream from Freres Crossing*



*Figure 16 Rocky bottom pool upstream from Freres Crossing*



## 4.2 Floods Creek, Somersby Falls

Floods Creek at Somersby Falls was visited as a comparison site for known habitat of Adam's Emerald Dragonfly (*Archaeophya adamsi*). This location is frequently cited as known habitat for *A. adamsi* (DPI, 2013).

Floods Creek and Somersby Falls are situated in Brisbane Water National Park at Somersby on the Central Coast. At the top of the falls Floods Creek is a shallow and narrow clear water mountain stream that flows over bare sandstone. The falls drop approximately 100 metres in a series of cascades to a steep and narrow lush rainforest canyon that continues to flow southward until it meets Mooney Mooney Creek, a tributary of the Hawkesbury River.

Downstream of Somersby Falls, Floods Creek is abundant in characteristic features of *A. adamsi* habitat. The stream is located below a closed canopy, with numerous riffle zones, mossy boulders and riparian vegetation. The substrate of the stream varied between bare sandstone, gravel and sand.

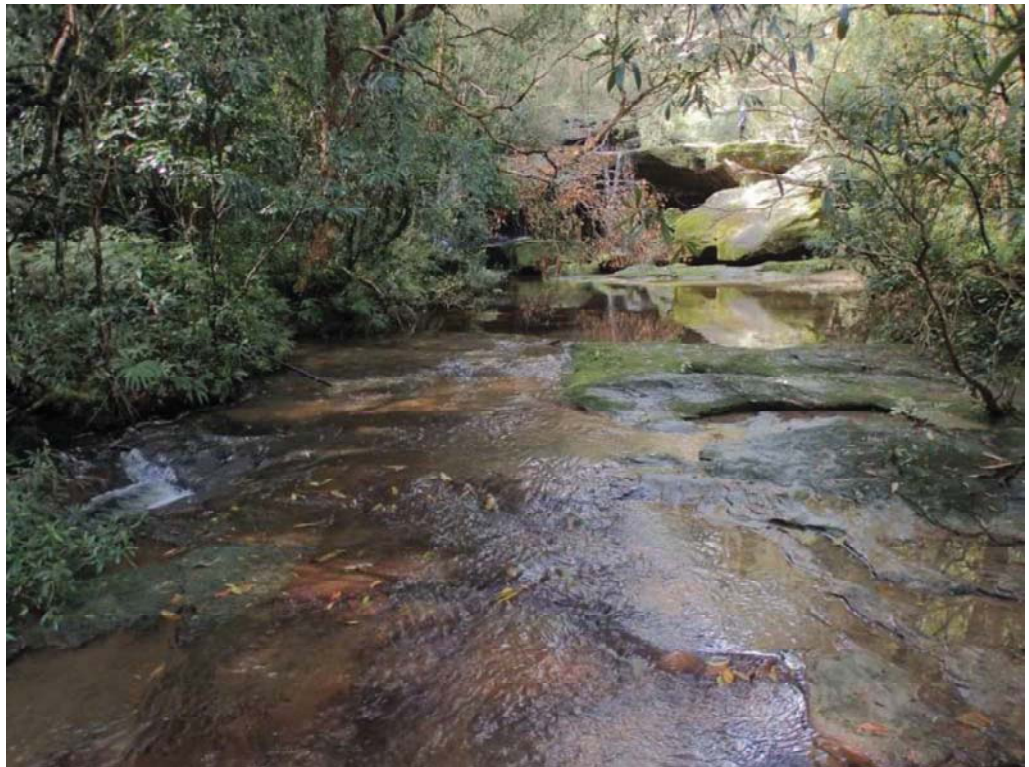
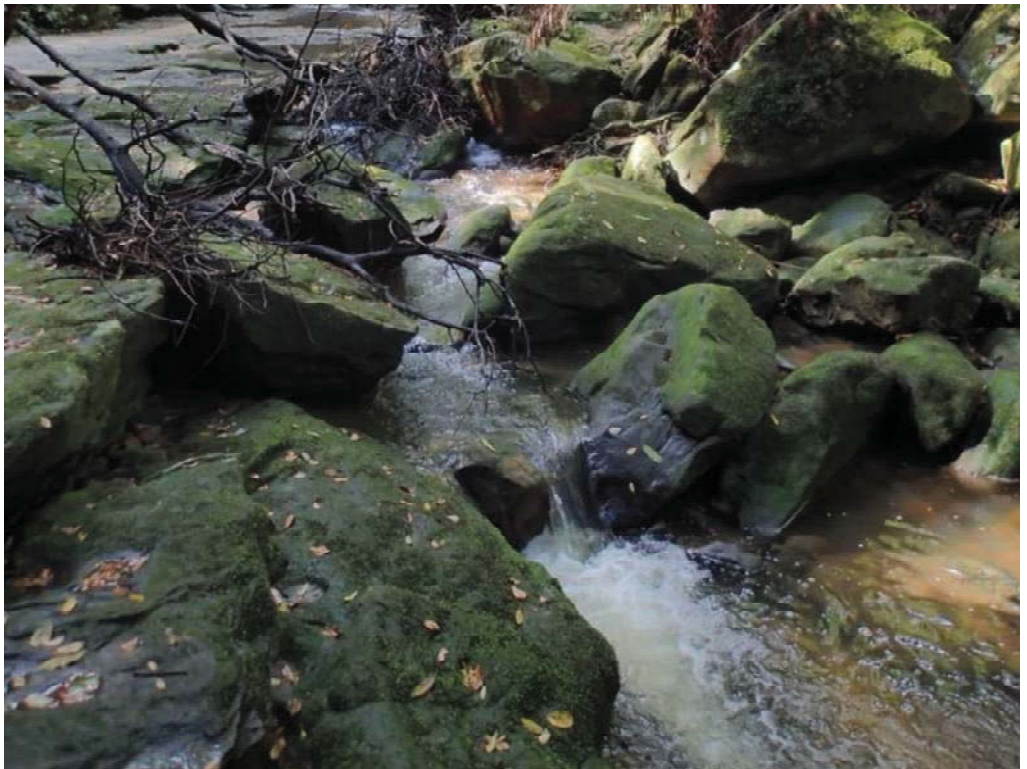


Figure 17 Floods Creek, habitat for *A. adamsi*. Narrow stream with shaded riffle zones, moss, riparian vegetation and sandy/gravel substrate.





*Figure 18 Floods Creek riffle zone.*



*Figure 19 Floods Creek riffle zone.*

## 5 HABITAT ASSESSMENT RESULTS

The Georges River within the survey area differs significantly from the character of the reference sites. The river at this location is characteristic of a lowland river on alluvial plains. The width varies between 25-45 metres, the channel is a continuous run and riffles or pools are absent. The water is turbid, the substrate consists of a fine mud and sand matrix and shading of the channel is minimal (<5%). Erosion of the riverbank varies from minor to severe; in some places, the entire bank has collapsed. The exposed banks are devoid of vegetation and the loose substrate is subject to further erosion.

Riparian vegetation is characterised by an open forest community that is degraded by dense infestation of exotic species, including several species declared as noxious weeds for Liverpool Local Government Area. Riparian vegetation generally did not overhang or shade the river. The canopy to 15 metres is dominated by *Eucalyptus botryoides* x *saligna*, with occasional occurrences of *Angophora subvelutina* (Broad-leaved Apple) and *Casuarina glauca* (Swamp Oak). Exotic trees such as *Jacaranda mimosifolia* (Jacaranda) and *Cinnamomum camphora* (Camphor Laurel) were recorded in low abundances.

The understorey is dominated by dense infestation of exotic species, such as *Lantana camara* (Lantana), Broad-leaf Privet (*Ligustrum lucidum*), Small-leaf Privet (*Ligustrum sinense*), *Olea europaea* subsp. *cuspidata* (African Olive), *Arundo donax* (Giant Reed) and *Cardiospermum grandiflorum* (Balloon Vine). Native species occur only occasionally throughout the understorey, predominantly small trees such as *Acacia binervia* (Coast Myall), *Acacia decurrens* (Black Wattle) and *Pittosporum undulatum* (Sweet Pittosporum).

Groundlayer vegetation along the banks of the river is generally absent due to the presence of impenetrable thickets of woody weeds. Native species such as *Pteridium esculentum* (Bracken), *Lomandra longifolia* (Spiny-head Mat-rush) occur in low abundances. Small, discrete patches of emergent vegetation are scattered along the river banks, with commonly occurring species included *Phragmites australis* (Common Reed), *Typha orientalis* (Broadleaf Cumbungi), *Gahnia* sp and *Eleocharis* sp.

Riparian vegetation is most intact in the upstream (southern extent) of the study area (GR01-GR20 see Figure 2) where the average width of the riparian corridor is at least 25 metres (Figure 20 & Figure 21). The canopy cover decreases in the mid-section of the survey area (GR21-GR40). The riparian corridor narrows to less than 25 metres with the occasional wider patch of adjacent woodland in the mid-section (Figure 22 & Figure 23). An intact riparian corridor is generally absent from the northern extent of the study area (GR41-GR60), where vegetation occurring along the banks of the river is limited to exotic grasses and scattered exotic shrubs such as *Solanum mauritianum* (Tobacco Tree) (Figure 24 & Figure 25). The banks of the Georges River beneath the twin bridges of the M5 are stabilised by rock gabion baskets, and vegetation is absent from this area.

The habitat assessment for the 60 sample locations failed to detect suitable threatened dragonfly habitat throughout the survey area (Table 2). Both east and west banks were similar in character, extent and type of riparian vegetation. There were no mid-stream habitat features such as riffles or pools and the substrate throughout the majority of the site is inappropriate for the target species. Frequent snags and woody debris provide some aquatic habitat, however emergent and trailing vegetation is sparse throughout the survey area. For a photo of the habitat at each sample location refer to Appendix B.

No areas of habitat have been identified for targeted dragonfly exuviae surveys within the survey area.

Table 2 Habitat features for target species are absent in the survey area

Species	Habitat features	Present in survey area?
Sydney Hawk Dragonfly <i>Austrocordulia leonardi</i>	<ul style="list-style-type: none"> <li>• Deep riverine pools with cool water</li> <li>• Permanently flowing rocky river with steep sides that provide shady rest areas</li> <li>• Rocks for larvae to shelter beneath</li> </ul>	<ul style="list-style-type: none"> <li>• No</li> <li>• No</li> <li>• No</li> </ul>
Adam's Emerald Dragonfly <i>Archaeophya adamsi</i>	<ul style="list-style-type: none"> <li>• Small to moderate sized creeks with gravel or sandy bottom</li> <li>• Narrow shaded riffle zones with moss and abundant riparian vegetation</li> <li>• Canopy cover</li> </ul>	<ul style="list-style-type: none"> <li>• No</li> <li>• No</li> <li>• No</li> </ul>



Figure 20 Upper third of the study area looking downstream 1





*Figure 21 Upper third of the study area looking downstream 2*



*Figure 22 Mid-section of the study area looking downstream 1*





*Figure 23 Mid-section of the study area looking downstream 2*



*Figure 24 Lower third of the study area looking downstream 1*



*Figure 25 Lower third of the study area looking toward west bank. M5 motorway to right of frame.*

## 6 CONCLUSION

The character of the Georges River within the survey area is markedly different from known habitat for the targeted threatened dragonfly species. No habitats for either *Archaeophya adamsi* or *Austrocordulia leonardi* were detected in the survey area after an extensive ecological assessment. It is thus highly unlikely that threatened dragonflies occur in the survey area and therefore no impact to these species is anticipated as a consequence of the MPW project.

Considering the absence of suitable habitat within the survey area, it is the recommendation of this assessment that no further investigation or targeted exuviae surveys are required.

## 7 REFERENCES

DPI Fisheries (2005) Sydney Hawk Dragonfly - *Austrocordulia leonardi*. Fisheries Scientific Committee determination January 2008 –FR28.

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## **APPENDIX A**

### **Habitat assessment pro-forma and guide**

**Example of completed pro-forma datasheet.**

Date: 13/9/12	Time: 10.32	GPS Waypoint: GR002	Recorder: LH AC
Photo ID/s: 0142			
<b>Physical features</b> <u>sandy bank, large fallen tree</u>			
Habitat feature:		Pool/Riffle depth (m): <u>N/A</u>	
<input checked="" type="radio"/> Edge <input type="radio"/> Riffle <input type="radio"/> Pool    Other: _____		River width at the water surface (m): <u>50</u>	
Turbidity:		Substrate Composition (%):	
Clear    Slight <input checked="" type="radio"/> Turbid    Opaque		Unknown Cobble ____ Pebble ____ Gravel ____ Sand ____ Fines <u>100</u>	
Bedform at sample location:		Bank Shape:	
Run    Pool    Backwater    Riffle    Other: <u>glide</u>		Concave <input checked="" type="radio"/> Convex    Stepped    Wide lower bench    Undercut	
In stream features: <input checked="" type="radio"/> Snags    Rocks    Debris    Algal blooms    Other: <u>sand bank</u>			
<b>Riparian Vegetation</b>			
Description (dominant species and community structure): <u>Open forest. Blackbutt, Ardisia decurrens, acacia binervia, bracken, cyperus, cotton weed</u>			
Extent of riparian cover (%):		Longitudinal extent of riparian vegetation:	
Trees: <u>40</u> Shrubs: <u>10</u> Grasses/Ferns/Sedges: <u>30</u> Climbers/creepers: <u>30</u>		None    Isolated/Scattered    Regularly spaced    Occasional Clumps <input checked="" type="radio"/> Semi-continuous    Continuous	
		Extent of Native/exotic vegetation	
		Weed dominated <input checked="" type="radio"/> Native dominated	
Cover of macrophytes (%):		Extent of trailing bank vegetation:	
Submerged: <u>5</u> Emergent: _____ Floating: _____		Nil <input checked="" type="radio"/> slight    moderate    extensive	
		Presence of moss at sample site:	
		Yes <input checked="" type="radio"/> No	
		Shading of channel:	
		<input checked="" type="radio"/> <5%    6-25%    26-50%    51-75%    >76%	

# Moorebank Precinct West – Appendix A – Dragonfly Habitat Assessment Datasheet and Guide

## **Habitat Assessment Guide (extracted from AUSRIVAS Physical Assessment Protocol)**

### GPS Waypoint:

Site identifier as mapped

### **PHYSICAL FEATURES**

#### Habitat Feature:

The surveyed entity type based on likely dragonfly habitat preferences.

*Edge* includes the bank of the river, riparian and fringing vegetation and the channel substrate.

*Pool* refers to an open area where stream widens or deepens and current declines. Habitat includes the channel substrate material.

*Riffle* includes a section with a gradient 1-3°. Moderate currents Surface unbroken but unsmooth

#### Pool/Riffle depth (m):

The average depth from the surface to the substrate for the mid-stream habitat feature. This variable does not apply to edge habitat features.

#### Turbidity:

At each sampling site, visually assess the turbidity of the water as one of the following categories:

Category	Description
clear	water very clear in pools and shallows
slight	water slightly turbid in pools and/or shallows
turbid	water moderately turbid in pools and/or shallows
opaque	water very turbid in both pools and shallows

Turbidity refers to the relative clarity of water and measures the extent to which light penetration is reduced from suspended materials such as clay, mud, organic matter or plankton. The presence of dissolved materials derived from plant leachates can also reduce water clarity (e.g. blackwater streams) and in such cases, water will be 'tea' coloured. The type of material causing any reduction in water clarity should be noted on the data sheet at each sampling site.






#### Substrate Composition:

Within the 10m long sample area, assess the relative percent cover of each of the following size classes:

Sediment category	Size
Bedrock	
Boulder	> 256mm
Cobble	64 – 256mm
Pebble	16 – 64mm
Gravel	2 – 16mm
Sand	0.06 – 2mm
Fines (silt and clay)	< 0.06mm




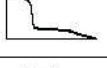
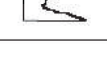
#### Bedform at sample location:

Determine the bedform of the river at the sample location based on the following options:

	<b>Riffle</b> Gradient 1-3° Moderate currents Surface unbroken but unsmooth
	<b>Glide</b> Gradient 1-3° Small currents Surface unbroken and smooth
	<b>Run</b> Gradient 1-3° Small but distinct & uniform current Surface unbroken
	<b>Pool</b> Area where stream widens or deepens and current declines
	<b>Backwater</b> A reasonable sized (>20% of channel width) cut-off section away from the channel

#### Bank Shape:

For edge habitat samples define the bank shape as follows:

	concave
	convex
	stepped
	wide lower bench
	undercut

Moorebank Precinct West – Appendix A – Dragonfly Habitat Assessment Datasheet and Guide  
**Habitat Assessment Guide (extracted from AUSRIVAS Physical Assessment Protocol) Continued**

**RIPARIAN VEGETATION**

Description:

The riparian zone is defined as the area from the water's edge (under baseflow conditions) to a distance from the bank where the stream still interacts with and influences the type and density of the bank-side vegetation. Where known, include a description of the main species present or the main vegetation types present (e.g. native grasses, rainforest, willows, river red gum, tea tree, casuarina, blackberries, paragrass etc.) in each vegetation component.

Extent of riparian cover (%)







At each sampling site, identify the riparian zone and visually estimate the percentage area of the riparian zone that is covered by each of the following components:

- Trees
- Shrubs
- Grasses/ferns/sedges

Longitudinal extent of riparian vegetation

Along the length of each 10 metre sampling site, visually assess the longitudinal extent, or patchiness, of the riparian zone on target bank. Include only the tree and shrub layer components (native or exotic) in the assessment of longitudinal extent, and disregard the ground cover layer. However, for sites where the riparian zone is naturally composed entirely of native grasses, either along the entire site length or in significant patches, include grasses in the assessment of longitudinal extent.

Assess longitudinal extent of riparian vegetation using one of the following categories:

Category	Description and examples <sup>1</sup> (shown for one bank only)
None	 No trees or shrubs, only exotic grasses or pasture
Isolated / scattered	 Isolated trees or shrubs among exotic grasses or pasture
Regularly spaced, single	 Planted poplars
Occasional clumps	 Clumps of tea tree scrub among exotic grasses or pasture
Semi-continuous	 Native forest with cleared areas of exotic grasses
Continuous	 Undisturbed native forest, river red gum canopy

Cover of macrophytes (%):

Estimate the percentage of macrophyte cover at the sample site:

- Submerged
- Emergent
- Floating

Extent of trailing bank vegetation:

Visually estimate the occurrence and density of trailing bank vegetation along the length of the sampling site as one of the following categories:

- Nil
- Slight
- Moderate
- Extensive

Trailing bank vegetation is the component of the terrestrial riparian vegetation that has direct contact with the water (under baseflow conditions) and which provides habitat and shelter for macroinvertebrates and fish.

Presence of moss at sample site:

Shaded sites with mossy vegetation are characterised as habitat for *Archaeophya adamsi*. Is moss present at the sample site?

Shading of channel:

At each 10 metre edge habitat sampling site, visually estimate the percentage of the stream area that would be shaded by riparian vegetation when the sun is directly overhead.



Extend of shading: < 5% shading (left), >76% shading (right)



## APPENDIX B

### Sample location photographs

Moorebank Precinct West

GR01  
(33.969898S  
150.912534E)



GR02  
(33.969537S  
150.912538E)



GR03  
(33.968949S  
150.91258E)





GR04  
(33.968388S  
150.912673E)



GR05  
(33.967872S  
150.91269E)



GR06  
(33.967255S  
150.912868E)





GR07  
(33.966737S  
150.912817E)



GR08  
(33.966208S  
150.91298E)



GR09  
(33.966043S  
150.913068E)





GR10  
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150.913163E)



GR11  
(33.965032S  
150.913355E)



GR12  
(33.9645S  
150.913412E)





GR13  
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150.913652E)



GR14  
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GR15  
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GR16  
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GR17  
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150.913265E)



GR18  
(33.962029S  
150.913132E)





GR19  
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GR20  
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GR21  
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GR22

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150.913148E)



GR23

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GR24

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GR25

(33.958147S

150.912469E)



GR26

(33.957564S

150.912355E)



GR27

(33.957002S

150.912377E)





Moorebank Precinct West – Appendix B – Dragonfly Habitat Assessment Datasheet and Guide  
GR28  
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GR29  
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150.912403E)



GR30  
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GR31  
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GR32  
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GR33  
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GR34

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GR35

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GR36

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GR37  
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GR38  
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GR39  
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150.913903E)



GR40

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150.914243E)



GR41

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150.914456E)



GR42

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150.914745E)





GR43

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GR44

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150.915524E)



GR45

(33.946559S  
150.916077E)





Moorebank Precinct West – Appendix B – Dragonfly Habitat Assessment Datasheet and Guide  
GR46  
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GR47  
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GR48  
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150.917925E)



Moorebank Precinct West – Appendix B – Dragonfly Habitat Assessment Datasheet and Guide  
GR49  
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GR50  
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GR51  
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GR52  
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GR53  
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150.918757E)



GR54  
(33.941422S  
150.918739E)



Moorebank Precinct West – Appendix B – Dragonfly Habitat Assessment Datasheet and Guide  
GR55  
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GR56  
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GR57  
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Moorebank Precinct West – Appendix B – Dragonfly Habitat Assessment Datasheet and Guide  
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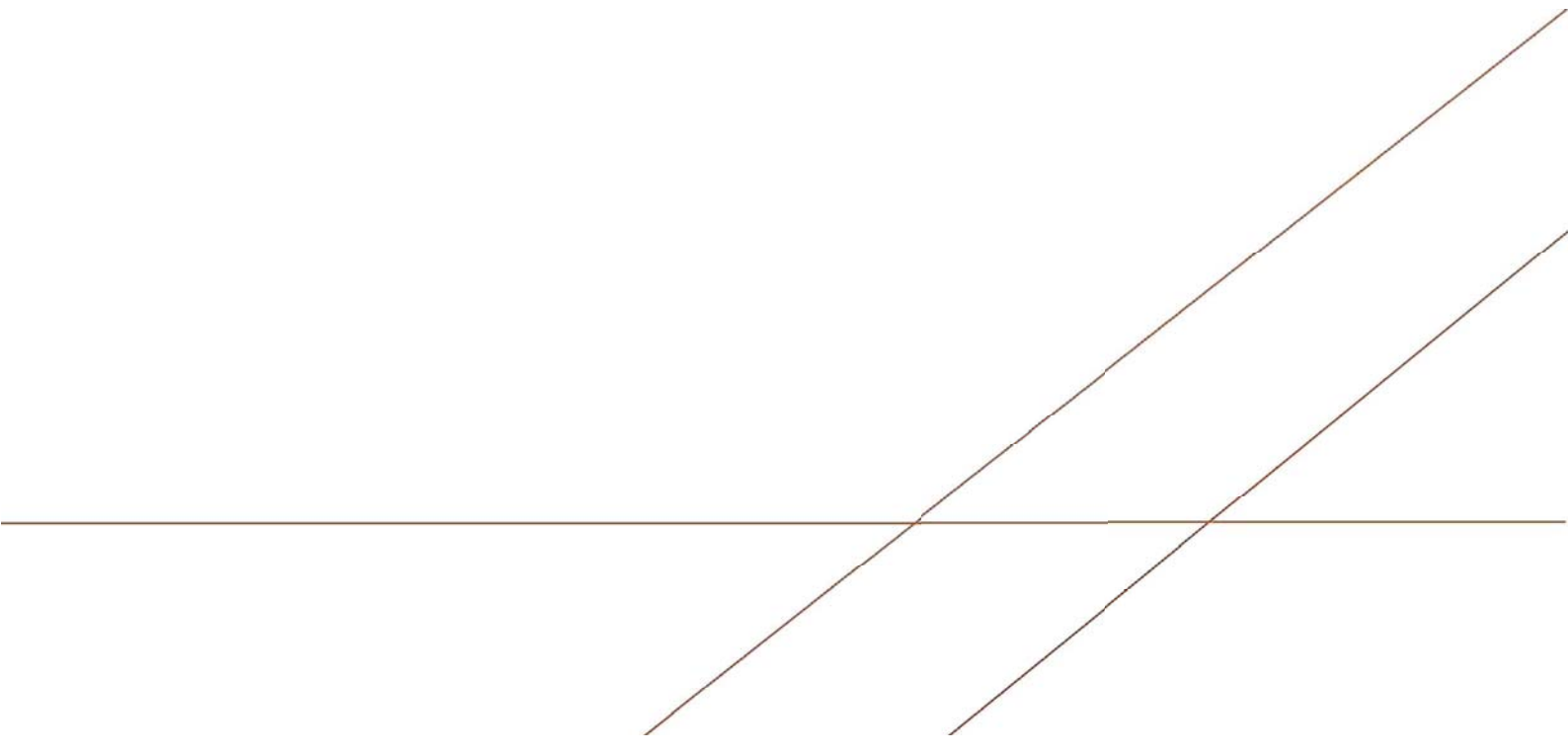


GR59  
(33.938327S  
150.919586E)



GR60  
(33.937788S  
150.919886E)





## Attachments

### **Attachment M: Riparian Vegetation Management Plan (Hyder 2015)**

*Refer to Appendix I of the Biodiversity Assessment Report (Appendix J to the Response to Submissions)*

# SIMTA Intermodal Terminal Facility- Stage 1

## Response to Submissions - Riparian Vegetation Management Plan



SIMTA

SYDNEY INTERMODAL TERMINAL ALLIANCE

Part 4, Division 4.1, State Significant  
Development





Hyder Consulting Pty Ltd

ABN 76 104 485 289

Level 5, 141 Walker Street

Locked Bag 6503

North Sydney NSW 2060

Australia

Tel: +61 2 8907 9000

Fax: +61 2 8907 9001

www.hyderconsulting.com



# SIMTA INTERMODAL TERMINAL FACILITY- STAGE 1 INTERMODAL TERMINAL FACILITY Riparian Vegetation Management Plan

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**Author**

Jane Rodd, Kate Carroll

**Checker**

Brad Searle

**Approver**

Westley Owers

**Report No**

AA003760

**Date**

10 September 2015

This report has been prepared for SIMTA in accordance with the terms and conditions of appointment for Stage 1 Intermodal Terminal Facility dated 7/10/2014. Hyder Consulting Pty Ltd (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

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# 1 INTRODUCTION

This Riparian Vegetation Management Plan (RVMP) has been prepared to guide the restoration of riparian vegetation at the Georges River and Anzac Creek in areas under the management of SIMTA. Crossings are proposed over the Georges River (proposed bridge) and Anzac Creek (proposed culvert) for the Rail link included for Stage 1 of the SIMTA Moorebank Intermodal Terminal Facility (the Proposal).

This document has been prepared to align with the management requirements, provided by the NSW Office of Water (NOW), outlined in Section 1.2 of this RVMP. It is important to note that the content of this document would be reviewed and updated, as necessary prior to construction of the Proposal.

This plan was originally placed on public exhibition (between 28 May 2015 and 26 June 2015) with the EIS (Appendix S) for the Proposal. During this public exhibition period submissions were invited from all stakeholders including members of the community and government stakeholders. An amendment to the Rail link is proposed by SIMTA, in response to submissions received during public exhibition and to reduce the overall environmental impact of the Proposal.

Key agency stakeholder submissions relating to riparian vegetation management received following public exhibition of the RVMP submitted with the EIS for the Proposal were from NSW Office of Water. The comments are summarised as follows:

- Clarifying the riparian corridor widths to be established along Anzac Creek and the Georges River and how they were determined
- Clarification as to why the Georges River management site does not include the adjacent riparian corridor on the western side of the Georges River.
- Details on the proximity of aquatic weeds to the construction site.
- Recommendation to include ongoing maintenance and monitoring, including maintenance of weeds, for the operational life of the Proposal.
- Recommendation to reuse topsoil on the site for revegetation and translocate plants.
- Recommendation to amend management measures to only revegetate temporarily cleared areas.

This RVMP updates that provided with the EIS to address any changes as a result of the amended Rail link and/or in response to submissions. This RVMP supersedes the RVMP provided within Appendix S of the EIS.

This report should be read in conjunction with the following:

- *Biodiversity Assessment Report* (BAR) (Hyder Consulting, September 2015)
- *Biodiversity Offset Strategy* (BOS) (Hyder Consulting, September 2015).

## 1.1 KEY TERMS

Table 1 provides a summary of the key terms which are included within this report. Figure 1 also provides an indication of the site areas discussed in this table.



**Table 1 Key terms**

Term	Description
Concept Plan Approval	Concept Plan Approval (MP 10_0193) granted on 29 September 2014 for the development of the SIMTA Moorebank Intermodal Terminal Facility at Moorebank. This reference includes the associated Conditions of Approval (CoA) and Statement of Commitments (SoC) which form the approval documentation for the Concept Plan Approval.
EPBC Approval	Approval (No. 2011/6229) granted under the EPBC Act on March 2014 by the Commonwealth Department of Environment for the development of the SIMTA Moorebank Intermodal Terminal Facility at Moorebank.
SIMTA Project	The SIMTA Moorebank Intermodal Terminal Facility at Moorebank as approved by the Concept Plan (MP_10_0913).
SIMTA site	Includes the former Defence National Storage and Distribution Centre (DNSDC) site, the land owned by SIMTA which is subject to the Concept Plan Approval (refer to Figure 1).
Rail Corridor	Area defined as the 'Rail Corridor' within the Concept Plan Approval. The rail link is also included within this area (refer to Figure 1).
Stage 1 site	The subject of this EIS, the western part of the SIMTA site which includes all areas to be disturbed by the Stage 1 Proposal (including the Operational area and Indicative Construction area) (refer to Figure 1). This area does <u>not</u> include the Rail Corridor.
Construction area	Extent of construction works, namely areas to be disturbed during construction of the Stage 1 Proposal (refer to Figure 1).
Operational area	Extent of operational activities for the operation of the the Proposal (refer to Figure 1).
Proposal site	Includes the Stage 1 site and the Rail Corridor, i.e. the area for which approval (construction and operation) is sought within this EIS.
Rail link	The rail link including the area on either side to be impacted by the construction works included in the Stage 1 Proposal.
Former DNSDC South	The land to the south of the operational footprint of the Intermodal Terminal, to the boundary fence of the former DNSDC.
Southern Boot Land	Commonwealth owned land to the south of Former DNSDC South, and to the north of the RailCorp Land (part of the Boot Land in the MIC proposal).
RailCorp Land	Lot 1 DP 825352 (part of the Rail Corridor) and owned by RailCorp.
The Proposal	Stage 1 of the SIMTA Moorebank Intermodal Terminal Facility including construction and operation of the intermodal terminal facility and rail link, i.e. all works and built form for which approval is sought in this EIS/Technical Report.

Term	Description
MIC Proposal	The development of an intermodal facility, associated commercial infrastructure (warehousing) and a rail link (3 options have been provided) to be located on the MIC site, for which an approval, under Part 4, Division 4.1 of the <i>Environmental Planning and Assessment Act 1979</i> . This proposal is currently under assessment by the Department of Planning and Environment.
MIC site	The former School of Military Engineering site to the immediate west of the SIMTA site, across Moorebank Avenue.

## 1.2 SITE LOCATION

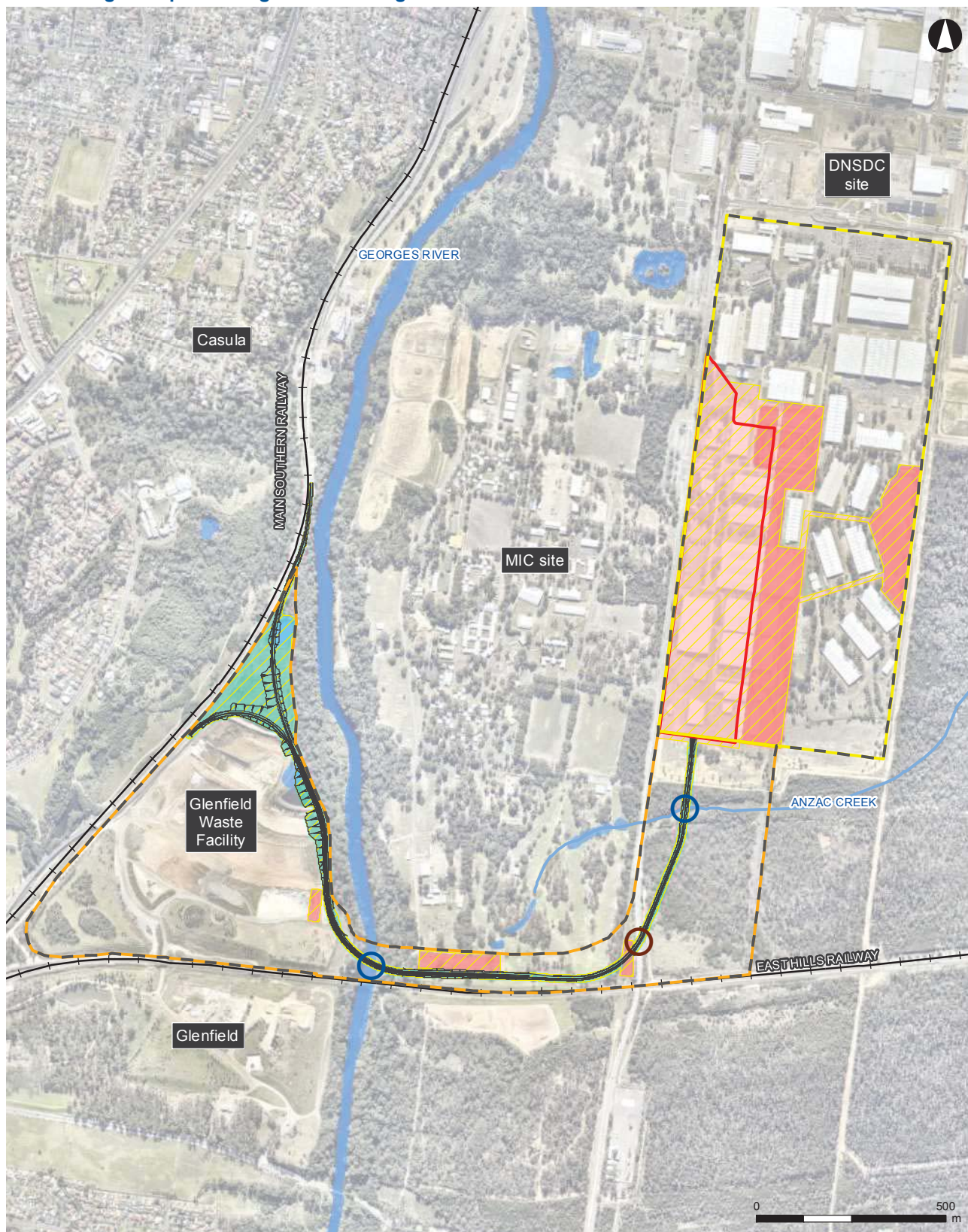
This RVMP applies to two management sites:

- The stretch of riparian vegetation adjoining both banks (east and west) of the Georges River within the Rail link and riparian vegetation on the eastern bank within the Rail Corridor (the **Georges River management site**). This includes a 50m riparian setback on the eastern bank and riparian vegetation extending further up the bank. The management site ranges in width from 80m to 120m. The management site on the western bank is approximately 30m in width to include the riparian vegetation to be temporarily disturbed for construction of the Rail link. The Glenfield Waste Facility is located on the boundaries of the management site and the remainder of the 50m riparian setback is cleared land. The surrounding lands are subject to management by Glenfield Waste Facility and does not form part of this management site.
- Anzac Creek and a riparian setback either side of the creek within the SIMTA Rail Corridor, ranging in width from 35m to 55m (the **Anzac Creek management site**). A 30m wide riparian corridor along either side of Anzac Creek was prescribed; however, this area includes vegetation that does not form part of the riparian zone. The RVMP applies to the Plant Community Types (PCTs) Coastal Freshwater lagoons of the Sydney Basin and South-east Corner (ME007) and Parramatta Red Gum Woodland on moist alluvium of the Cumberland Plain, Sydney Basin (ME005) within the riparian area. The extents of these PCTs have been determined with reference to the vegetation mapping by DECCW (2009), verified by field survey. Cleared and disturbed areas on the southern bank of Anzac Creek to the west of the proposed Rail link have also been included in the management site. Vegetation outside the ground-truthed riparian zone, but within the 30m setback will be managed under the Threatened Flora Species Management Plan (Appendix J of this RtS) and/or the Biodiversity Offset Management Plan, as stipulated in the Biodiversity Offset Strategy (Appendix J of this RtS).

Figure 2 indicates the location of these two management sites in relation to the Proposal, with more detail of the extent of each site on Figure 3 and Figure 4.

It should be noted that both management sites (excluding the western bank of the Georges River) form part of the proposed offset sites for the Proposal (Appendix J of this RtS). The offset sites will be managed in perpetuity under a Biodiversity Offset Management Plan.

# SIMTA Stage 1 Riparian Vegetation Management Plan



## LEGEND

- |                         |   |                      |
|-------------------------|---|----------------------|
| Project site            | Construction area                                   | Creek/River crossing |
| Rail corridor           | Rail Link (including 20m width and variable buffer) | Road crossing        |
| SIMTA site              | Stage 1 site  | Existing railway     |
| Operational area        | Compound sites                                      | Watercourse          |
| Proposed rail alignment |   |                      |

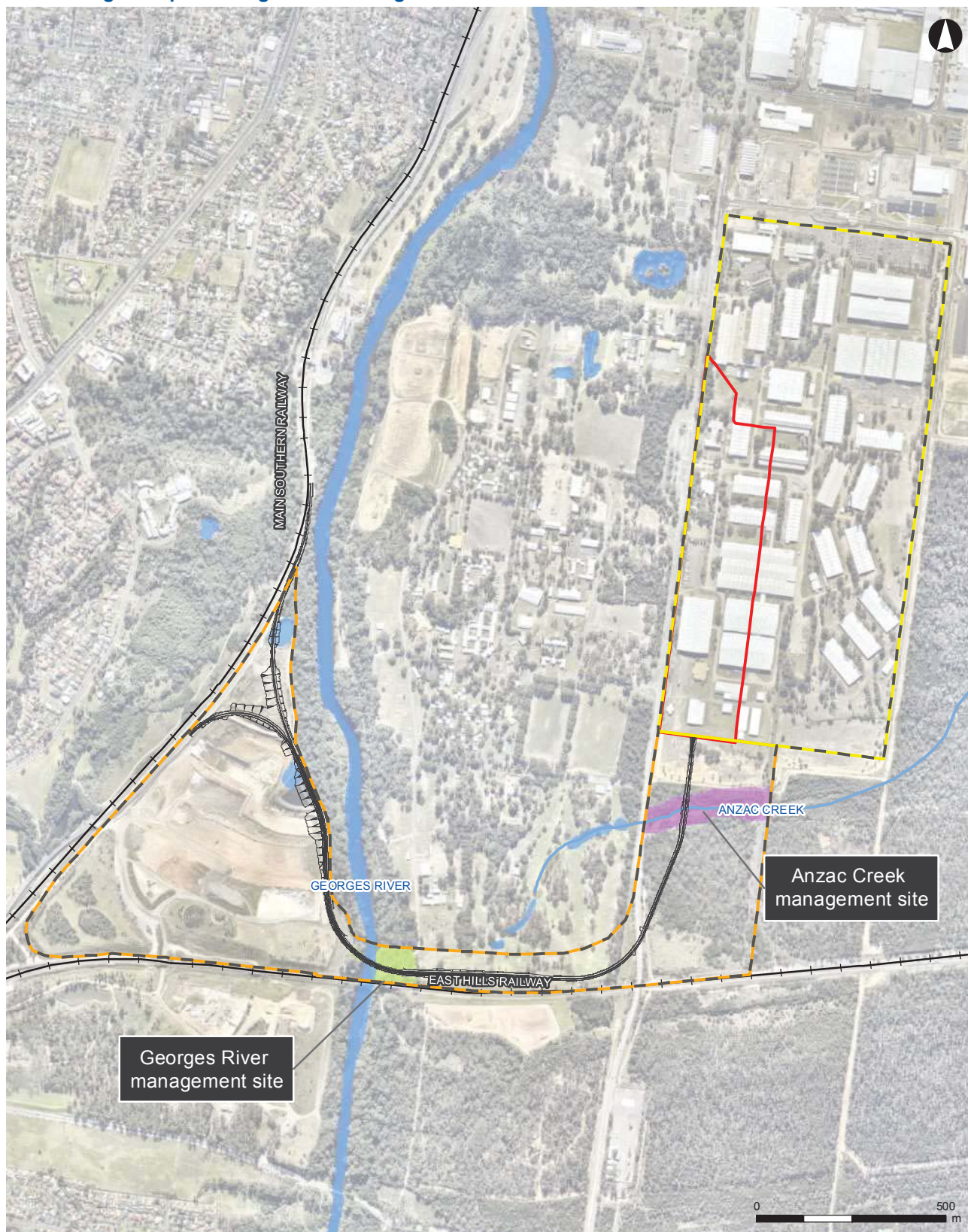
HYDER CONSULTING PTY LTD  
 ABN 76 104 485 289  
 Level 5, 141 Walker St  
 North Sydney NSW 2060  
 Australia  
 P: +61 (0) 2 8907 9000  
 F: +61 (0) 2 8907 9001



Figure 1: Site map



## SIMTA Stage 1 Riparian Vegetation Management Plan



### LEGEND

- |  |                  |  |                               |
|--|------------------|--|-------------------------------|
|  | Project site     |  | Anzac Creek management site   |
|  | Rail corridor    |  | Georges River management site |
|  | SIMTA site       |  | Proposed rail alignment       |
|  | Operational area |  | Existing railway              |
|  | Watercourse      |  |                               |

HYDER CONSULTING PTY LTD  
 ABN 76 104 485 289  
 Level 5, 141 Walker St  
 North Sydney NSW 2060  
 Australia  
 P: +61 (0) 2 8907 9000  
 F: +61 (0) 2 8907 9001



Figure 2: Location of management sites in relation to the Proposal



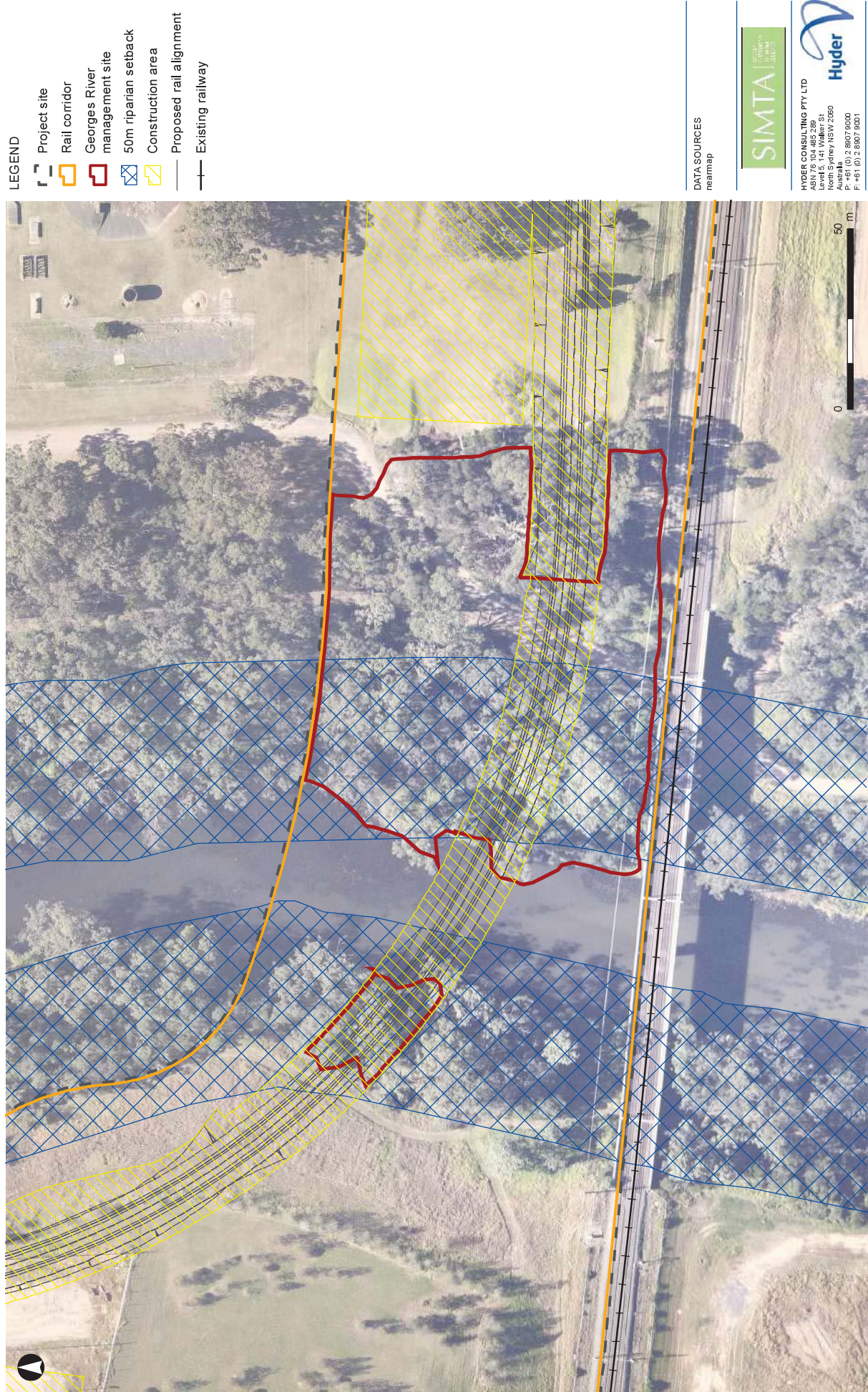


Figure 3: Georges River management site



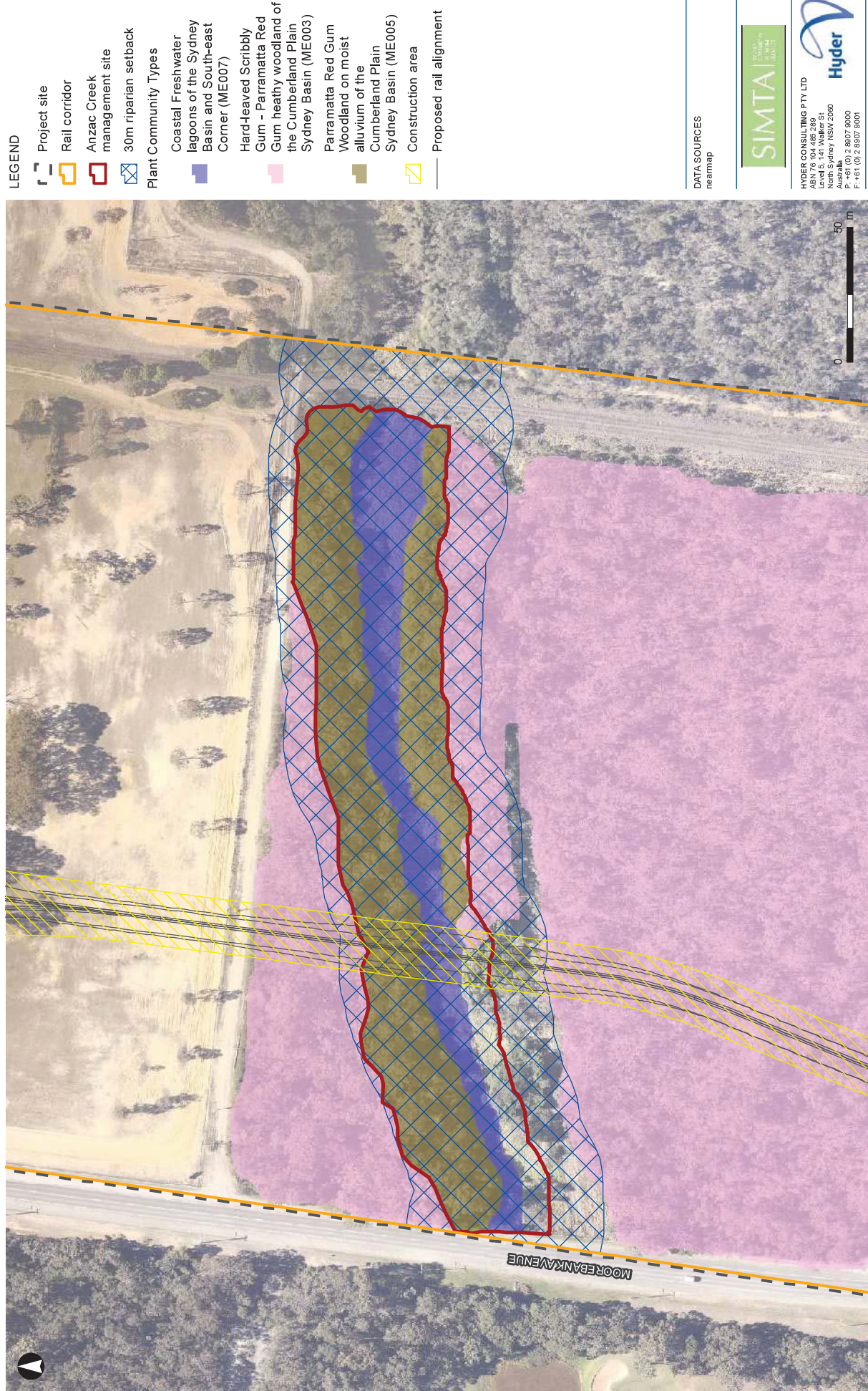


Figure 4: Anzac Creek management site

## 1.3 MANAGEMENT PLAN REQUIREMENTS

### NSW Office of Water

The NSW Department of Planning and Environment (DPE) issued Secretary's Environmental Assessment Requirements (SEARs) for the Proposal in December 2014 (SSD 14-6766). Condition 12(c) of the SEARs states that the Flora and Fauna Assessment is to include a Vegetation Management Plan that has been prepared in consultation with the NSW Office of Water (NOW).

NOW provided correspondence dated 16 April 2015, including the following advice:

#### *Riparian corridors along the Georges River and Anzac Creek*

*...approximately 0.22 hectares of riparian vegetation would be removed at the river banks for the installation of the bridge and abutments and 0.08 hectares of riparian vegetation would be impacted by the installation of the culvert/rail link at Anzac Creek. It is recommended the EIS includes:*

- *details on the existing and proposed riparian corridor widths to be established along the river and Anzac creek (measured from top of bank)*
- *a scaled plan which shows the proposed crossing options, existing riparian vegetation, the riparian corridor width and the riparian corridors that will be affected by the crossings*

*Riparian corridors along the Georges River and Anzac Creek that are affected by the project should be appropriately revegetated to restore the ecological functional and habitat values. The EIS should provide details on the riparian corridor widths to be established to inform the riparian areas that are proposed to be disturbed by the project and areas that need to be revegetated/rehabilitated with local providence species.*

*A Vegetation Management Plan (VMP) should be prepared which details the riparian corridor areas affected by the proposal and the regeneration/rehabilitation of riparian vegetation.*

### Other relevant Management Plans (MIC site)

Parsons Brinckerhoff (2014) prepared a Management Plan for Restoration of the Riparian Zone of the Georges River as part of the Ecology Assessment for the MIC Proposal. The management plan was prepared for the riparian lands adjacent to the eastern bank of the Georges River within the MIC site. The riparian area addressed in the MIC management plan includes the Georges River management site in this plan. This plan has been prepared to maintain consistency with the MIC plan, where feasible and reasonable.

## 1.4 OBJECTIVES

The objectives of the RVMP are to:

- Restore, conserve and enhance the riparian vegetation in the Georges River and Anzac Creek site that fall within the SIMTA Rail Corridor
- Long term eradication of weed species from the management sites
- Maintain an adequate width of riparian vegetation adjoining Georges River and Anzac Creek
- Protect and enhance fauna habitat connectivity along the Georges River and Anzac Creek riparian zone.

## 1.5 APPROACH

This RVMP has been prepared in accordance with the following:

- *Guidelines for vegetation management plans of waterfront land*, NSW Office of Water
- *SIMTA Intermodal Terminal Facility – Stage 1 Biodiversity Assessment Report* (Hyder Consulting 2015).

This RVMP also aims to be complementary to, and consistent with, the adjacent Management Plan for Restoration of the Riparian Zone of the Georges River prepared as part of the *Ecological Impact Assessment* for the MIC Proposal prepared by (Parsons Brinckerhoff, 2014).

## 1.6 STRUCTURE OF THIS PLAN

This RVMP has been structured according to the following:

- Section 2 outlines legislation and guidelines applicable to this RVMP
- Section 3 provides an overview of the site context, including landuse, landform, soil conditions and vegetation
- Section 4 establishes management strategies for rehabilitation of the riparian corridor, including protection of native vegetation, weed management and general habitat management and restoration
- Section 5 details the adaptive management and continual improvement framework which applies to this plan.
- Section 6 defines roles and responsibilities associated with the plan.



## 2 LEGISLATION AND GUIDELINES

### 2.1 COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the EPBC Act as Matters of National Environmental Significance (MNES). MNES identified in the Act include:

- World heritage properties
- National heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Threatened species and communities
- Migratory species protected under international agreements
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mines).

The part of the site on the eastern bank of the Georges River is located within Commonwealth Land, and therefore all impacts on the environment of this section of the site are governed by the EPBC Act.

Also of relevance the EPBC Approval (No. 2011/6229) granted in March 2014 for the impact of the SIMTA Project on listed threatened species and communities (sections 18 and 18A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)) and Commonwealth land (sections 26 and 27A of the EPBC Act). This approval facilitates, subject to state approval, the construction of the proposed Georges River and Anzac Creek crossings.

### 2.2 THE AUSTRALIAN WEEDS STRATEGY

The Australian Weeds Strategy (Natural Resource Management Ministerial Council 2006) replaces the National Weeds Strategy, providing a national framework for the reduction of the economic, environmental, and social impacts of weeds. Weed management is recognised as essential to the sustainable management of natural resources, the economy, the environment, human health and amenity. The Strategy addresses the prevention of new weed problems, abatement of existing weed problems, and the enhancement of capacity to combat weed problems.

The Strategy aims to complement and guide the efforts of state, territory, regional, and local government strategies and initiatives by providing a national framework. Building on the National Weeds Strategy created in mid-1997, the Australian Weeds Strategy continues the core objective of the National Weeds Strategy by identifying Weeds of National Significance (WONS) and the resultant coordinated actions across Australia. Weeds of National Significance are determined by the following four criteria:

- level of invasiveness
- environmental impacts
- potential for spread

- socio-economic and environmental values (Natural Resource Management Ministerial Council 2006).

Of relevance to the managements sites within the Proposal site which are the subject of this RVMP are the management guidelines for the WONS which occur on the Proposal site.

## 2.3 NSW THREATENED SPECIES CONSERVATION ACT 1995

The NSW *Threatened Species Conservation Act 1995* (TSC Act) provides for the protection and management of threatened species, populations and ecological communities listed under schedules 1, 1A and 2 of the Act. The TSC Act also lists Key Threatening Processes (KTPs) that “threaten or could threaten the survival or evolutionary development of species, populations or ecological communities”. They are listed under Schedule 3 of the TSC Act and may adversely affect threatened species, populations or ecological communities or could cause species, populations or ecological communities that are not threatened to become threatened. KTPs identified as potentially associated with management of riparian and aquatic values on the site include:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands
- Infection of native plants by *Phytophthora cinnamomi*
- Invasion of native plant communities by exotic perennial grasses
- Invasion and establishment of exotic vines and scramblers
- Invasion, establishment and spread of *Lantana camara*
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
- Loss of hollow-bearing trees.

## 2.4 NSW WATER MANAGEMENT ACT 2000

The *Water Management Act 2000* (WM Act) provides for the sustainable and integrated management of the water sources of NSW. The WM Act regulates controlled activities carried out in, on or under waterfront land through a requirement for a permit; clause 89J of the EP&A Act provides an exemption for these permits for SSD assessed under Part 4, Division 4.1 of the EP&A Act (under which approval of the Proposal is sought).

When a proposed controlled activity disturbs or substantially modifies the riparian corridor, a VMP detailing how restoration or rehabilitation of the corridor will be carried out would be required. Although a controlled activity permit is not required for the Proposal, management of riparian corridor values would maintain consistency with the guidelines issued by NOW for vegetation management plans on waterfront land.

## 2.5 NSW NOXIOUS WEEDS ACT 1993

The *Noxious Weeds Act 1993* (NW Act) aims to reduce the negative impact of weeds on the economy, community and environment and to provide for the monitoring of and reporting on the effectiveness of the management of weeds in NSW. The NW Act provides for the identification, classification and control of noxious weeds, and imposes obligations on occupiers of land to control noxious weeds declared for their area.

## 3 CURRENT SITE CONDITIONS

### 3.1 LAND USE

The vegetation of the Georges River site adjoins the Glenfield Waste Facility to the west, and the RAE Golf Course currently on the MIC site to the east. The Georges River management site is located immediately to the north of the East Hills railway line.

The Anzac Creek management site is within the Southern Boot Land to the south of the SIMTA site and Stage 1 site. The Southern Boot Land supports native vegetation with some historical disturbance. Anzac Creek flows east across the northern section of the Southern Boot Land, with native vegetation adjoining the drainage line to the north and south. The creek passes through a culvert beneath an existing rail spur that runs north-south across the eastern edge of the Rail corridor.

### 3.2 LANDFORM

The Georges River management site is characterised by the floodplain and banks of the section of Georges River which the management site adjoins. The approximately 100 metre extent of the riparian corridor in the management site comprises:

- A flat alluvial terrace of variable width, only slightly elevated above the river
- A moderately to steeply sloped embankment
- A gently sloped to flat upper bank and floodplain.

The eastern bank of the Georges River within the management site is generally higher and with a steeper embankment than the western bank.

The section of Anzac Creek within the management site consists of a shallow muddy waterbody, with gently sloping creek banks.

### 3.3 HYDROLOGY

#### **Georges River**

The Georges River is located within the Georges River catchment and the Liverpool District sub-catchments and Mid Georges River catchment. It enters the Liverpool LGA from the south on the western side of the Defence Lands at Holsworthy and flows north, meeting with Glenfield Creek at Casula. From here the Georges River continues to flow north past the Liverpool City Centre, under Newbridge Road, past Lighthorse Park and over the Liverpool Weir. Downstream of the Liverpool Weir, the Georges River becomes slightly salty (estuarine) and is more subject to tidal influences.

#### **Anzac Creek**

Anzac Creek originates from within the Royal Engineers Golf Course, to the west of Moorebank Avenue, and flows in a north-east direction across the Rail Corridor, just south of the SIMTA site and Stage 1 site. The creek flows north past the adjoining suburbs of Wattle Grove and Moorebank before draining into Lake Moore in Chipping Norton, which in turn flows into the Georges River.

## 3.4 SOIL CONDITIONS

The soil landscapes of the Penrith 1:100 000 sheet were mapped by Bannerman and Hazelton (1990). The features and locations of the mapped soil landscapes of the management sites are detailed in Table 2.

**Table 2 Soil landscapes mapped in management sites by Bannerman and Hazelton (1990)**

Soil Landscape	Features (Bannerman and Hazelton 1990)	Location in Proposal site
Berkshire Park (Fluvial)	Orange heavy clays and clayey sands, often mottled; ironstone nodules common. On dissected, gently undulating rises on the Tertiary terraces of the Hawkesbury/Nepean river system.	Eastern bank of Georges River and Anzac Creek site.
Richmond (Fluvial)	Poorly structured orange to red clay loams, clays and sands; ironstone nodules may be present. Landscape is Quaternary terraces of the Nepean and Georges Rivers, mainly flat.	100m wide strip adjoining western bank of Georges River.

## 3.5 AQUATIC ENVIRONMENT

An aquatic ecology assessment was undertaken as part of the *Flora and Fauna Assessment* (Hyder Consulting, 2011) for the Concept Plan Approval.

The aquatic survey conducted in the proximity of the proposed Georges River railway crossing, identified two species of fish, including one specimen of the native Flathead Gudgeon (*Philypnodon grandiceps*) and the introduced Gambusia (*Gambusia holbrooki*) (Hyder Consulting 2011). The AUSRIVAS macroinvertebrates results for the Georges River rated the sampling site in Band C, suggesting that it is 'severely impaired' with fewer macroinvertebrate families observed than expected.

The Georges River in the vicinity of the Proposal site was 40 to 60 metres wide, and the bank dropped rapidly to a depth of 1.2 metres before falling away at a steadier grade. Aquatic habitats present included soft substrate pool habitat, large woody debris and extensive macrophyte cover. Overhanging vegetation, fallen logs, mats of sticks, submerged (*Elodea canadensis*) and floating aquatic plants (*Azola* sp., *Salvinia molesta*) were present throughout the Proposal site and reach along the bank.

Fish surveys of Anzac Creek identified only one species, introduced Gambusia (*Gambusia holbrooki*). The overall AUSRIVAS rating for macroinvertebrates in Anzac Creek was Band B indicating that the macroinvertebrate community was 'significantly impaired'.

## 3.6 VEGETATION

### 3.6.1 VEGETATION COMMUNITIES

#### **Georges River management site**

The land within approximately 100 metres of the eastern bank of the Georges River supports forest vegetation. On the steep slope adjacent to the riverbank was severely degraded riparian vegetation, currently reduced to mature trees of *Eucalyptus saligna* x *botryoides* (Blue Gum/Bangalay hybrid) and *Eucalyptus longifolia* (Woollybutt) with an understorey dominated by



*Ligustrum sinense* (Small-leaved Privet) and smothered by exotic weeds, mainly *Cardiospermum grandiflorum* (Balloon Vine), *Lantana camara* (Lantana) and *Delairea odorata* (Cape Ivy) (Plate 1, Plate 2).

The vegetation was less disturbed upslope and included a mixed native and exotic understorey with mature trees of *E. saligna x botryoides*. Given the relatively low native diversity coupled with low exotic cover in upslope areas, it is possible that there has been weed removal in this area and that the native understorey is regenerating.



**Plate 1. Degraded riparian vegetation on eastern bank of Georges River**

**Plate 2. Degraded riparian vegetation**

On the western bank of the Georges River, adjacent to the Glenfield Waste Facility, the vegetation was similar in structure and condition to that on the eastern bank. The riparian vegetation within the management site is approximately 30 metres in width. The riparian forest supported a canopy dominated by *Eucalyptus saligna x botryoides* to 20 metres in height (Plate 3).

The understorey on the river flats near the existing rail bridge consisted of a mixture of local native shrub, herb and grass species and some dense stands of *Olea europaea* subsp. *cuspidata* and *Lantana camara*, with *Tradescantia fluminensis* dominating the ground layer in some areas.



**Plate 3. Edge of riparian vegetation on western bank of Georges River in south of site**

The vegetation adjoining the Georges River in the management site was classified as Plant Community Type ME018: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin, based on previous regional mapping as an equivalent vegetation type, landscape position, and absence of any other appropriate equivalent

PCT in the VIS database. This vegetation meets the criteria for the endangered ecological community River-flat Eucalypt Forest as listed under the TSC Act.

Riparian vegetation associated with Georges River maintains connectivity with riparian vegetation to the north and south, including the Holsworthy Military Area. This riparian corridor may facilitate the movement of less mobile species, including cover-dependent species, larger terrestrial mammals and arboreal mammals. The riparian vegetation also forms potential habitat for a number of threatened fauna species identified as potentially occurring in the Rail Corridor.

### Anzac Creek

The section of Anzac Creek within the management site consists of a shallow muddy waterbody, with limited standing water observed at the time of survey, supporting dense stands of *Typha orientalis* (Broad-leaf Cumbungi) and *Bolboschoenus fluviatilis* (Club-rush) with *Alternanthera philoxeroides* (Alligator Weed) abundant in the lower stratum. In 2011 and 2012, a dense infestation of *Salvinia molesta* (Salvinia) was observed on the creek surface immediately to the west of the existing railway line (Plate 4, Plate 5). This was not observed during vegetation surveys in 2014.



**Plate 4. Anzac Creek to west of existing rail spur, showing *Salvinia molesta* infestation in foreground and native sedges and rushes further upstream**



**Plate 5. Ground layer of wetland in Anzac Creek**

Fringing Anzac Creek is a narrow band of swamp woodland dominated by *Melaleuca linariifolia* (Flax-leaved Paperbark); the understorey of this forest varied from sedges, especially *Leptocarpus tenax* which dominated in patches, to ferns, grasses and dense shrubs. To the south of the eastern part of Anzac Creek there were occasional emergent trees of *Angophora subvelutina* (Broad-leaved Apple) and *Eucalyptus sclerophylla*.

Adjoining the southern bank of the western section of Anzac Creek the vegetation is disturbed and dominated by exotic vegetation, with a large stand of *Phyllostachys aurea* (Golden Bamboo), thickets of *Acacia decurrens* (Black Wattle) and *Pennistemon clandestinum* forming a carpet over a raised, uneven ground surface, likely to be fill material deposited in this location decades ago (Plate 6). Exposed soil beneath a fallen tree showed soil mixed with broken concrete tiles (Plate 7). *Agave americana* (Century Plant) and *Aloe maculata* (Common Soap Aloe) were also growing in this location, suggesting dumped landscape or garden waste.



**Plate 6. Disturbed area south of Anzac Creek:**  
*Pennisetum clandestinum*, *Agave americana* and  
*Phyllostachys aurea*

**Plate 7. Exposed fill material in disturbed area**

## 3.6.2 WEEDS

### Noxious Weeds

There are 11 plant species recorded in the riparian management zones listed as noxious weeds in the Liverpool City Council LGA (Table 3). Six of the noxious weeds are also listed as Weeds of National Significance under the National Weeds Strategy (Thorp and Wilson 2012).

**Table 3 Noxious weeds recorded in the management sites**

Scientific name	Common name	Noxious weed control class	Weed of National Significance	Location
<i>Alternanthera philoxeroides</i>	Alligator Weed	3	Yes	Well established throughout Anzac Creek, wetlands on western side of Georges River
<i>Asparagus asparagoides</i>	Bridal Creeper	4	Yes	Banks of Georges River
<i>Lantana camara</i>	Lantana	4	Yes	Banks of Georges River
<i>Ligustrum lucidum</i>	Broad-leaved Privet	4	No	Western bank of Georges River
<i>Ligustrum sinense</i>	Small-leaved Privet	4	No	Banks of Georges River
<i>Ludwigia peruviana</i>	Peruvian Primrose	3	No	Anzac Creek, in wetland on western side of Georges River
<i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive	4	No	Banks of Georges River
<i>Opuntia</i> sp.	Prickly Pear	4	Yes	Banks of Georges River

Scientific name	Common name	Noxious weed control class	Weed of National Significance	Location
<i>Phyllostachys aurea</i>	Golden Bamboo	4	No	Southern bank of Anzac Creek
<i>Rubus fruticosus</i> agg. spp. (includes <i>R. anglocandicans</i> )	Blackberry	4	Yes	Banks of Georges River, in disturbed bushland south of Anzac Creek
<i>Salvinia molesta</i>	Salvinia	2	Yes	On Anzac Creek upstream of the existing culvert during 2012 surveys. This infestation was not present in 2014/2015 surveys. The species was not identified in the vicinity of the proposed works.

The most severe weed infestations were on the lower slopes adjoining the banks of the Georges River, where there were large stands of privet *Ligustrum sinense* (Small-leaved Privet) and *Lantana camara* (Lantana).

The control requirements for the classes of noxious weeds recorded in the management sites are presented in Table 4.

**Table 4 Weed control classes and requirements**

Control Class	Weed type	Control requirements
Class 2	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 3	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.	The plant must be fully and continuously suppressed and destroyed.
Class 4	Plants that pose a potentially serious threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.	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.

## Environmental Weeds

In addition to the declared noxious weeds on the management site, there are a number of weedy exotic species which pose a threat to the biodiversity values of the management sites (Table 5).



**Table 5 Environmental weeds recorded in the management sites**

Scientific name	Common name
<i>Asparagus aethiopicus</i>	Asparagus Fern
<i>Bidens pilosa</i>	Cobblers Pegs
<i>Cardiospermum grandiflorum</i>	Balloon Vine
<i>Chloris gayana</i>	Rhodes Grass
<i>Delairea odorata</i>	Cape Ivy
<i>Ehrharta erecta</i>	Panic Veld-grass
<i>Eragrostis curvula</i>	African Lovegrass
<i>Lonicera japonica</i>	Honeysuckle
<i>Ochna serrulata</i>	Mickey Mouse Plant
<i>Sida rhombifolia</i>	Paddy's Lucerne
<i>Tradescantia fluminensis</i>	Wandering Jew

## 4 VEGETATION MANAGEMENT MEASURES

Management and restoration strategies for the site include:

- Protection of remnant native vegetation
- Site preparation, including demolition of structures and clearing
- Weed control
- Revegetation
- Soil erosion control and drainage works
- Fauna habitat enhancement.

Each of these strategies includes a number of specific actions designed to meet the objectives of the plan, namely to:

- restore and revegetate the riparian zone to be consistent with and complementary to areas of remnant indigenous vegetation within the Georges River Corridor
- eradicate weed species on the sites, with a particular focus on priority weeds
- maintain an adequate width of riparian vegetation adjoining Georges River and Anzac Creek.
- improve habitat for aquatic fauna as well as terrestrial species
- protect and enhance fauna habitat, including habitat for threatened species.

### 4.1 SITE ESTABLISHMENT AND PROTECTION OF NATIVE VEGETATION

Prior to commencement of on-site works, all areas of retained riparian forest not within the Proposal footprint will be identified and marked on site. Exclusion fences will be installed and maintained around this vegetation for the duration of the construction period of the Proposal.

Vegetation clearing will be carried out to the extent required for the proposed bridge and culvert construction. Clearing of the Construction area should avoid spread of weed propagules into adjoining retained vegetation. It will be important to remove as much of the existing weed source as possible prior to clearing if reserved topsoil and/or mulched vegetation are to be re-used within management sites as part of the restoration process.

Site preparation undertaken prior to planting will ensure that bank stabilisation is not compromised.

### 4.2 SOIL EROSION CONTROL AND DRAINAGE WORKS

Soil stabilisation may be required for riparian areas where bank erosion is deemed a risk and advice will be sought from the Engineering Manager or Environmental Officer as to whether stabilisation is a requirement in areas where construction is occurring adjacent to the creek banks, or where weed removal may result in bank instability. Where required, a thick jute mesh or suitable alternative will be applied to these areas, which will also act as a weed suppressant. Should invasive bank stabilisation works be required along the riparian embankment, this will occur after primary weed control.

The risk of bank erosion may also be reduced through revegetation. Hydromulching using native grass seeds may be effective for initial erosion control of recently cleared areas. When undertaking tubestock planting of slopes, selection of hardy, deep-rooted native shrub species should further contribute to bank stability.

## 4.3 WEED CONTROL

### 4.3.1 PRIMARY WEED CONTROL

Primary weed control will be carried out prior to the commencement of the proposed bridge and culvert construction works. Planning would allow for sufficient time to remove target weeds or treat them with herbicide to achieve a complete kill (i.e. root death).

Weed management of the site requires the continual suppression of noxious and invasive weeds, with a focus on weed species that are currently present in dense infestations on the sites, namely:

- *Alternanthera philoxeroides* (Alligator Weed) – abundant cover in Anzac Creek
- *Cardiospermum grandiflorum* (Balloon Vine) – smothering native vegetation on east bank of Georges River
- *Lantana camara* (Lantana) – dense cover in riparian forest on both banks of the Georges River.
- *Ligustrum lucidum* and *L. sinense* (Privet) – dense cover on both banks of the Georges River.

It is important to avoid disturbance, where possible, to the unstable alluviums which form the banks of the Georges River by removing the stabilising vegetation. As much of the stabilising vegetation currently comprises woody weeds and exotic grasses, progressive removal of weed thickets is recommended.

To reduce impacts on water quality, soil disturbance and herbicide use in proximity to waterways should be minimised. Silt traps downstream of any soil disturbance should reduce sediment and nutrient pollution. The use of “cut and paint” techniques is preferable to broad spectrum spraying as they will minimise the potential transport of herbicide into waterways.

The aim of weed management is the long-term eradication of noxious and invasive weeds from the management sites, which will contribute to regional management outcomes for the Georges River riparian corridor. Successful long-term weed management will require long-term maintenance as it is likely that weeds will be re-introduced to the site from upstream areas, given the wind, water and animal-assisted dispersal abilities of many of the weed species present on the site. Restoration of native vegetation on the site should eventually result in lower weed densities and will require regular monitoring and spot-treatment of weed infestations.

## 4.4 WEED CONTROL METHODS

Table 6 provides a summary of the priority weeds and the strategies for their removal from the management sites. Table 7 identifies other noxious weeds and associated control strategies.

**Table 6 Priority weeds and proposed control strategies**

Weed species	Location and extent of species within management sites	Control strategy
<i>Alternanthera philoxeroides</i> Alligator Weed	Present in high abundance in the channel of Anzac Creek and has also been recorded in the Georges River management site.	<p>This species is difficult to control and may require an integrated long-term management approach using both physical removal and chemical control techniques. Removal of this weed from Anzac Creek may be problematic as it is an established infestation and has formed large aquatic mats across the water surface, interspersed with native sedges.</p> <p>The recommended method for ongoing suppression of an infestation of the size in Anzac Creek is a long-term program of annual herbicide application using metsulfuron-methyl (DPI 2007).</p> <p>It should be noted that metsulfuron-methyl products are registered only for use on terrestrial alligator weed, and they may be applied to aquatic infestations only under the conditions of a current Australian Pesticides and Veterinary Medicines Authority (APVMA) permit.</p>
<i>Cardiospermum grandiflorum</i> Balloon Vine	Forms a dense layer smothering vegetation on the flats and steep eastern bank of the Georges River.	<p>A combination of manual and chemical control is recommended.</p> <p>Areas of dense infestation should be sprayed with herbicide, targeting vines at the base of native trees as a priority.</p> <p>Cut vine stems and paint with herbicide.</p> <p>Remove canopy growth if possible with a brush hook or similar tool.</p>
<i>Lantana camara</i> Lantana	Dense stands present on both banks of the Georges River.	<p>Mechanical control of dense infestations may be undertaken where practicable, otherwise manual removal is recommended.</p> <p>Follow up with herbicide control and ongoing spot-spraying while native vegetation re-establishes.</p>
<i>Ligustrum lucidum</i> and <i>L. sinense</i> Privet	Dense stands present on both banks of the Georges River.	<p>A range of manual and chemical control methods should be used for both Privet species, including strategic hand removal of small to medium plants and stem injection or frilling and pasting of herbicide for larger individuals. Long term integrated management of these species will be necessary.</p>



**Table 7 Other noxious weeds and proposed control strategies**

Scientific name	Management site	Control methods
<i>Asparagus asparagoides</i> Bridal Creeper	Georges River	Ongoing herbicide control.
<i>Ludwigia peruviana</i> Peruvian Primrose	Anzac Creek, Georges River	Manual removal or chemical control.
<i>Olea europaea</i> subsp. <i>cuspidata</i> African Olive	Georges River	Manual removal of small to medium plants and cutting and painting with herbicide for larger individuals.
<i>Opuntia</i> sp. Prickly Pear	Georges River	Manual removal followed up with spot spray.
<i>Rubus fruticosus</i> agg. spp. (includes <i>R. anglocandicans</i> ) Blackberry	Georges River	Manual removal and chemical control.
<i>Salvinia molesta</i> Salvinia	Anzac Creek	The infestation of this weed in Anzac Creek observed in 2011 and 2012 appears to have been significantly reduced in 2015 observations. Further control should focus on monitoring and containing any new infestations.

#### 4.4.1 SECONDARY WEED CONTROL

Given that weed species are likely to be re-introduced to the management sites from adjoining and upstream areas, ongoing maintenance will be required. There is also likely to be a large amount of weed seed stored in the soils of the sites, particularly at the Georges River management site. Controlling weeds in their early stages of growth is preferable.

Secondary weed control will be undertaken quarterly with consideration given to the life cycle of the species and will follow the requirements as described for primary weeding. Weed control effort will increase as growth is accelerated in the warmer seasons. As weeds in the riparian zone may have been transported from upstream areas, opportunities to co-ordinate site weed control activities with regional weed control programs will be investigated through contact with Liverpool and Campbelltown Councils and Greater Sydney Local Land Services.

#### 4.4.2 PREVENTING FURTHER SPREAD OF WEEDS

All construction machinery used within the construction site and/or management sites to clear weed-infested vegetation or to remove weeds is to be thoroughly cleaned by removing all plant material and soil (potentially containing weed seeds and propagules) prior to leaving site.

Equipment used for treating weed infestation will be cleaned prior to moving to a new area within the management sites to minimise the likelihood of transferring any plant material and soil.

### 4.4.3 HERBICIDES

The type of herbicides used will be in accordance with the *NSW Pesticides Act 1999* and follow the species specific recommendations made in the *Noxious and Environmental Weed Control Handbook - A guide to weed control in non-crop, aquatic and bushland situations* (6th Ed) (NSW DPI 2014). Only herbicides registered for aquatic use should be applied in areas adjacent to waterbodies. Additionally, the use of herbicides must comply with label instructions and the Material Safety Data Sheet (MSDS) for the product.

## 4.5 REVEGETATION

Plants will be propagated from native seed collected from the management sites and surrounding areas prior to vegetation clearing. Revegetating the site with local provenance species will maximise the recovery potential of the site as these are adapted to the local environmental and climatic conditions. Where species cannot be sourced from the site but are required to assist in regeneration, these should be collected from within 5 kilometres of the site. Material collected from native vegetation to be cleared for bridge construction, such as seed-bearing branches and mulched native vegetation, should be used as far as is practicable. Collection of seed will be undertaken in accordance with Florabank Guidelines and by an experienced Bushland Regenerator in possession of the appropriate licenses under the *National Parks and Wildlife Act 1974*.

Where possible, topsoil in the riparian areas removed for the Proposal would be reused for revegetation. This would only occur if the following conditions are met:

- Topsoil is sourced from an area with low densities of weed
- Topsoil would only be reused for revegetation of the same PCT as its source

The 20 m wide Rail link would be stabilised following construction with local topsoil with growth of groundcover encouraged. This corridor would be managed by removing weeds and reducing the fuel load.

A potential species list or planting list for the site has been prepared, based on the native species recorded within and adjacent to the management sites at the time of survey (Table 8). The final planting list will be based largely on the seed available to be collected from the site and the suitability of the seed stock to be germinated and propagated under nursery conditions.

**Table 8 Indicative species list for revegetation**

Species	
Canopy trees	Herbs and groundcovers
<i>Eucalyptus saligna x botryoides</i>	<i>Dichondra repens</i>
<i>Eucalyptus longifolia</i>	<i>Einadia hastata</i>
<i>Casuarina glauca</i>	<i>Gahnia clarkei</i>
	<i>Lomandra longifolia</i>

Species	
<b>Small trees and shrubs</b>	<i>Oxalis perennans</i>
<i>Acacia binervia</i>	<i>Plectranthus parviflorus</i>
<i>Acacia decurrens</i>	<i>Pratia purpurascens</i>
<i>Acacia floribunda</i>	<b>Climbers and twiners</b>
<i>Breynia oblongifolia</i>	<i>Billardiera scandens</i>
<i>Bursaria spinosa</i>	<i>Cassytha pubescens</i>
<i>Exocarpos cupressiformis</i>	<i>Clematis aristata</i>
<i>Leucopogon ericoides</i>	<i>Clematis glycinoides</i>
<i>Melaleuca linariifolia</i>	<i>Glycine clandestina</i>
<i>Notelaea longifolia</i>	<i>Glycine tabacina</i>
<i>Ozothamnus diosmifolius</i>	<i>Parsonsia straminea</i>

Planting methods should include a combination of direct seeding, branch spread, and tubestock planting. Hydromulching of highly disturbed, unstable slopes with native grass seeds may be undertaken if considered appropriate.

### **Tubestock planting**

- Tubestock should be planted in spring or autumn.
- Tubestock is to be planted in a mixed species order. One tree or shrub and four groundcovers are to be planted per square metre (possibly more on steep slopes). Given that patches of remnant vegetation are already present on the site, tubestock planting will prioritise those areas where large numbers of weeds have been removed.
- Protect tubestock with guards and mulch well to minimise weeds and retain moisture. Mulch is to be sourced from the site and certified not to contain weed species.
- Water in well and replant failed plants as necessary after 1 month. Water weekly if conditions are hot.
- Maintain weed control in planted areas.
- A watering program is to be implemented for established plants and continued for at least 12 months.

## 4.6 FAUNA HABITAT ENHANCEMENT

### Georges River

The vegetation of the Georges River riparian corridor forms an important habitat linkage for native fauna species. The Biodiversity Assessment report for the Proposal (Hyder Consulting, 2015) found:

- Canopy trees supporting small to medium-sized branch hollows are located on the western bank of the Georges River. These hollows offer potential nesting and roosting habitat to hollow-dependent fauna. Decorticating bark of eucalypts on both sides of the river offers potential roosting habitat to microchiropteran bat species.
- Dense infestations of weedy shrubs such as *Lantana camara* and *Ligustrum* spp. offer potential sheltering and foraging habitat to native birds.
- Leaf litter and small ground timber offers shelter and foraging habitat to small terrestrial mammals and reptiles.

The construction of the bridge over the Georges River will require clearance of a 20 metre wide corridor across the riparian zone. The bridge abutments are located approximately 60 to 70 metres from the water's edge on either side of the Georges River, and two groups of piers will be installed on either side of the river between the abutments and the water.

The gap between the East Hills Rail Line bridge and the proposed 11.3 metres wide rail bridge will be between 20 and 30 metres on the eastern bank of the Georges River and between 50 and 70 metres on the western side of the Georges River. The vegetation between the two bridges will be retained and the eastern side would be managed under this plan. The area beneath and adjoining the proposed rail bridge which would be cleared for construction will be revegetated with the objective of maintaining and enhancing fauna habitat.

Revegetation of the 20 metre wide gap cleared for the bridge will be primarily with shrub, small tree and groundcover species. Planting and management of adjacent areas on the eastern bank will ensure that trees are located as close as possible to the bridge, without posing a safety risk to the operation of the Rail link. Species in the revegetation area will be selected to provide habitat resources for native fauna, such as structural habitat components or food sources.

Additional measures proposed to enhance fauna habitat in the Georges River corridor include:

- Installation of nest boxes in retained native vegetation. A Nest Box Management Plan would be prepared which would outline the installation and monitoring requirements of the nest boxes.
- Placement of cut logs and branches cleared from the construction zone into retained vegetation to provide fauna habitat components.

### Anzac Creek

The proposed Anzac Creek culvert is an eight cell concrete box culvert, each cell being 1800 mm high and 2100 mm wide. It features six wet cells, following the natural contours of the creek, to allow for fish passage and two dry cells, one on either end of the culvert, to allow for terrestrial fauna passage. The dry cells would be constructed by filling the two concrete cells with rock to a height of 800 mm. This would allow a height of one metre from the roof of the cell to the fill surface for dry passage. The dry cells are located adjacent to the wing walls at the creek bank. Provision of the dry cells should maintain fauna connectivity across the rail corridor to the north and south of Anzac Creek.



## 4.7 SUMMARY OF VEGETATION MANAGEMENT MEASURES

Table 9 provides a summary of the vegetation management activities to be undertaken as part of this RVMP, as well as information on the proposed timing, frequency and expected outcomes of each action.

**Table 9 Summary of vegetation management measures**

Action	Timing			Frequency	Location		Outcome	Responsibility
	Pre-clearing	Construction/ clearing	Maintenance		Georges River	Anzac Creek		
Site establishment and protection of native vegetation								
Clearly identifying sensitive areas ('no-go areas') which cannot be impacted by construction and manage clearing such that clearing activities are constrained to these approved areas only.	✓	✓		Once only and then maintained	✓	✓	Prevent over clearing	Construction contractor and Stage 1 Proposal operator
High visibility plastic fencing is to be installed to clearly define the limits of the Construction area, including the Rail link and works areas around watercourse crossings.	✓	✓		Once only and then maintained	✓	✓	Prevent disturbance or over clearing of fauna habitat and native vegetation outside the development footprint	Construction contractor
The extent of vegetation clearing is to be clearly identified on construction plans.	✓			Prior to construction	✓	✓	Prevent impacts to fauna habitat and native vegetation outside the development footprint	Construction contractor or Site Operator
Instream works at Georges River and Anzac Creek would be minimised as much as possible, including disturbance to aquatic vegetation. Disturbed areas (within the riparian corridors) would be contained to the 20m wide Rail Corridor.		✓		As clearing occurs	✓	✓	Minimise harm to fish habitat.	Construction contractor

Action	Timing			Frequency	Location		Outcome	Responsibility
	Pre-clearing	Construction/ clearing	Maintenance		Georges River	Anzac Creek		
Weed control								
Primary weed control of the management sites	✓	✓	✓	Monthly prior to and during construction period and for a 12 month period following construction.	✓	✓	Removal of dense weed cover from management sites (where practicable)	Bush regeneration contractor
Follow-up weed control and inspection			✓	Quarterly for a three to five year period following construction.	✓	✓	Ongoing suppression of weeds	Bush regeneration contractor
Management of noxious weeds is to be undertaken in accordance with the <i>Noxious Weeds Act</i> 1993.	✓	✓	✓	As per weed control frequency.	✓	✓	Prevent weed establishment and invasion	Construction contractor and Site Operator
Equipment used for treating weed infestation will be cleaned prior to moving to a new area within the management site to minimise the likelihood of transferring any plant material and soil.	✓	✓	✓	As per weed control frequency.	✓	✓	Prevent weed establishment and invasion	Construction contractor and Bush regeneration contractor
Soil stripped and stockpiled from areas containing known weed infestations are to be stored on cleared land at least 40 m from native vegetation.		✓		As soil disturbance occurs.	✓	✓	Prevent weed establishment and invasion	Construction contractor

Action	Timing			Frequency	Location		Outcome	Responsibility
	Pre-clearing	Construction/ clearing	Maintenance		Georges River	Anzac Creek		
Soil excavated from the Anzac Creek corridor must be disposed of in accordance with the guidelines in the <i>Alligator Weed Control Manual</i> (DPI 2007), as it will likely contain fragments of Alligator Weed.		✓		As excavation occurs.		✓	Prevent further spread of the noxious weed <i>Alternanthera philoxeroides</i>	Construction contractor
<b>Revegetation</b>								
Undertake seed collection, where possible, at least 12 months prior to the commencement of revegetation.	✓	✓	✓	Initial seed collection period prior to and during construction. Further collections may be required over time for replacement of tubestock planting.	✓	✓	Maintain genetic integrity of native vegetation in management sites.	Bush regeneration contractor
Propagation of tubestock from collected seed	✓	✓	✓	For initial planting and ongoing replacement planting	✓	✓	Provision of healthy, viable local native plants for revegetation	Bush regeneration contractor
Planting and direct seeding in areas of retained vegetation after completion of primary weed control works		✓	✓	Initial planting and then as required	✓	✓	Revegetation of disturbed areas using local native plants	Bush regeneration contractor
Where possible, topsoil in the riparian areas removed for the Proposal would be reused for		✓	✓	Initial revegetation	✓	✓	Revegetation of disturbed areas using local native plants	Construction contractor or Bush



Action	Timing			Frequency	Location		Outcome	Responsibility
	Pre-clearing	Construction/ clearing	Maintenance		Georges River	Anzac Creek		
revegetation. This would only occur if the following conditions are met: <ul style="list-style-type: none"> <li>Topsoil is sourced from an area with low weed density</li> <li>Topsoil would only reused for revegetation of the same PCT as its source</li> </ul>								regeneration contractor
Riparian areas that are temporarily cleared for construction adjoining the Georges River would be revegetated as soon as practicable upon completion of bridge works.			✓	Initial planting with ongoing replacement planting to be determined through ongoing quarterly/annual monitoring.	✓		Retain habitat connectivity along riparian corridor of the Georges River	Construction contractor or Bush regeneration contractor
The 20m wide Rail link would be stabilised following construction with local topsoil with growth of groundcover encouraged. The corridor would be managed by removing weeds and reducing the fuel load.		✓	✓	Initial stabilisation works and management as per weed control frequency.			Prevent weed establishment and invasion and retain Rail link in a low fuel state	Construction contractor or Bush regeneration contractor
<b>Fauna habitat enhancement</b>								
Fauna microhabitat such as logs should be removed from areas to be cleared and relocated to suitable		✓		Once during clearing.	✓		Retain fauna habitat resources	Construction contractor

Action	Timing			Frequency	Location		Outcome	Responsibility
	Pre-clearing	Construction/ clearing	Maintenance		Georges River	Anzac Creek		
nearby bushland areas in the presence of an ecologist.								
Install nest boxes in retained native vegetation in the riparian corridor of the Georges River and the woodland in the Boot Land prior to clearing of hollow-bearing trees. A plan including nest box management procedures would be prepared which would outline the installation and monitoring requirements of the nest boxes.	✓	✓		Once prior to clearing, with annual monitoring and maintenance.	✓		Replace lost hollow resources in the landscape	Construction contractor
Large woody debris would be retained in watercourses where possible. In the event large woody debris are to be impacted they would be relocated in consultation with an ecologist.		✓		Ensure minimal disturbance during construction.	✓		Minimise harm to fish habitat.	Construction contractor
<b>Soil erosion control and drainage works</b>								
Install appropriate drainage infrastructure (e.g. sediment basins, diversion drains), sediment and erosion controls prior to the commencement of construction.	✓	✓		Once during construction, with regular maintenance checks.	✓	✓	Prevent sedimentation and erosion leading to a reduction in water quality and degradation of aquatic habitats in Georges River and/or Anzac Creek	Construction contractor

Action	Timing			Frequency	Location		Outcome	Responsibility
	Pre-clearing	Construction/ clearing	Maintenance		Georges River	Anzac Creek		
Clearing of vegetation is not to be undertaken during overland flow events.		✓		As clearing occurs.	✓	✓	Prevent sedimentation and erosion leading to a reduction in water quality and degradation of aquatic habitats in Georges River and/or Anzac Creek	Construction contractor
Locate soil or mulch stockpiles away from watercourses and key stormwater flow paths and include appropriate erosion and sediment controls to limit potential transport of these substances into the watercourses via runoff.		✓		As clearing occurs.	✓	✓	Prevent soil and mulch reaching waterways	Construction contractor
Dust suppression activities to be undertaken where appropriate.		✓		As clearing occurs.	✓	✓	Prevent sedimentation and erosion leading to a reduction in water quality and degradation of aquatic habitats in Georges River and/or Anzac Creek	Construction contractor
Stabilisation of temporarily disturbed areas, including revegetation, is to be undertaken as soon as practicable after disturbance.		✓	✓	As clearing occurs and as required during 12 month maintenance period.	✓	✓	Prevent sedimentation and erosion leading to a reduction in water quality and degradation of aquatic	Construction contractor and Stage 1 Proposal operator

Action	Timing			Frequency	Location		Outcome	Responsibility
	Pre-clearing	Construction/ clearing	Maintenance		Georges River	Anzac Creek		
							habitats in Georges River and/or Anzac Creek	
<b>Approvals and permits</b>								
Permit to collect seed and plant propagules from River Flat Eucalypt Forest EEC under S132C of the <i>National Parks and Wildlife Act 1974</i> (from OEH).	✓			Once only unless personnel change	✓	✓	Collection of seed in accordance with regulations.	Construction contractor or Bush regeneration contractor
Permit to undertake revegetation and restoration works within River Flat Eucalypt Forest and Freshwater Wetlands EECs under S132C of the <i>National Parks and Wildlife Act 1974</i> (from OEH).	✓			Once only unless personnel change	✓	✓	Revegetation and restoration in accordance with regulations	Construction contractor or Bush regeneration contractor
Appropriate APVMA permits for herbicide use, particularly if a non-registered use is proposed (i.e. for Alligator Weed)	✓			Once only unless personnel change	✓	✓	Use of herbicide in accordance with regulations.	Construction contractor or Bush regeneration contractor
<b>Monitoring and reporting</b>								
Preparation of monitoring reports during the construction and maintenance period		✓	✓	Quarterly during construction period and for the following 12	✓	✓	Determine whether the restoration works are achieving performance	Ecologist/Bush regeneration contractor



Action	Timing			Frequency	Location		Outcome	Responsibility
	Pre-clearing	Construction/ clearing	Maintenance		Georges River	Anzac Creek		
				months upon completion of construction, then annual reports thereafter as part of offset management.			criteria, implementing corrective actions as required.	

## 5 ADAPTIVE MANAGEMENT AND CONTINUAL IMPROVEMENT

### 5.1 MONITORING, REVIEW AND REPORTING

Monitoring and review of the implementation of the RVMP against established performance criteria will be undertaken by a qualified ecologist at intervals of six months for the first three years of the management period, and subsequently at 12 month intervals. The primary intent of the monitoring program is to demonstrate compliance with the RVMP via compliance with performance criteria for the restoration works.

Issues may arise in the implementation of the plan which would require actions to be modified or additional actions to be implemented. The monitoring program will be designed to detect issues at an early stage such that appropriate adaptations can be made to ensure that objectives are met.

### 5.2 PERFORMANCE CRITERIA

Performance criteria applicable to this RVMP include:

- Certification that all plant stock used for revegetation are of local botanical provenance
- Gradual improvement of native plant establishment with the aim of achieving 80% cover of native vegetation after five years following initial planting
- Gradual reduction in weed density to 5% of total area of each management site (eastern bank of Georges River and Anzac Creek only)
- Reduction in weed density to 5% of total area of management site 5 years after construction (western bank of Georges River only)
- Gradual extension of native plant cover in each management site through natural regeneration
- Stability of riparian banks, including maintenance or reduction of erosion within management sites
- Re-establish and maintain connectivity for fauna habitat, particularly in the Georges River management site.

### 5.3 REPORTING AND TIMING

Reporting would be required annually to assess the success of works in accordance with the performance criteria outlined above. Reporting undertaken during maintenance inspections of each management site will be undertaken by the Contractor's bush regeneration representative and ecologist.

## 6 ROLES AND RESPONSIBILITIES

Key roles and responsibilities associated with the implementation of this Plan are presented in Table 10. Broadly, the management and implementation of the RVMP will be the responsibility of a qualified and experienced ecologist reporting directly to the applicant, with on-ground regeneration works and maintenance the responsibility of a qualified and experienced Bush regeneration contractor. Specific management actions associated with each role are identified in Table 9.

**Table 10 Roles and responsibilities**

Role	Responsibility
Site Operator	Co-ordination of RVMP with Construction contractor and bush regeneration contractor and ecologist (where required).  Completion of site management to ensure ongoing protection of regenerated sites post-construction period.
Construction Contractor	Co-ordination of RVMP associated conditions with the clearing and construction works ensure native vegetation is protected and enhanced through the life of the Proposal.  Completion of site management to ensure ongoing protection of management sites during construction period.  Compliance with the relevant conditions of the RVMP
Bush Regeneration Contractor	On-ground works associated with the RVMP, maintenance inspections and meeting of performance criteria, where required.  Certification of supply and installation of local provenance native seed.
Ecologist	Management and implementation of RVMP, including performance indicator monitoring, provision of technical advice and statutory reporting.

## 7 REFERENCES

- Bannerman S.M. & Hazelton P.A. (1990) *Soil Landscapes of the Penrith 1:100,000 Map Sheet* (Soil Conservation Service NSW, Sydney)
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- Hyder Consulting (2015) *SIMTA Intermodal Terminal Facility – Stage 1 Amended Biodiversity Assessment Report*. Hyder Consulting, North Sydney.
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- Thorp, J.R. and Wilson, M (2012) *Weeds Australia* - [www.weeds.org.au](http://www.weeds.org.au) accessed 23 July 2012.



## **Attachments**

### **Attachment M: Riparian Vegetation Management Plan (Hyder 2015)**

*Refer to Appendix I of the Biodiversity Assessment Report (Appendix J to the Response to Submissions)*