LENDLEASE COMMUNITIES

LINKS ROAD EXTENSION

STATEMENT OF ENVIRONMENTAL EFFECTS

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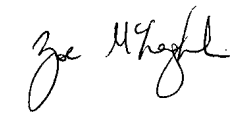
Links Road Extension
Statement of Environmental Effects

Lendlease Communities

WSP
Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001

Tel: +61 2 9272 5100
Fax: +61 2 9272 5101
wsp.com

REV	DATE	DETAILS
B	21/11/2018	Original

	NAME	DATE	SIGNATURE
Prepared by:	Zoe McLaughlin	21/11/2018	
Reviewed by:	Andréa Zambolt	21/11/2018	
Approved by:	Andréa Zambolt	21/11/2018	

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ABBREVIATIONS

BC Act	*Biodiversity Conservation Act 2016*
ACM	asbestos containing material
AHIMS	Aboriginal Heritage Information Management System
CBD	Central business district
CEMP	Construction environmental management plan
CNVMP	Construction noise and vibration management plan
DA	Development Application
DSI	Detailed site investigation
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESCP	Erosion and Sediment Control Plan
LALC	Local Aboriginal land council
LGA	Local government area
LoS	level of service
mBGL	metres below ground level
MNES	Matters of national environmental significance
NCA	Noise catchment area
NEPM 2013	National Environment Protection (Assessment of Site Contamination) Measure 2013
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
OEH	Office of Environment and Heritage
PAD	Potential archaeological deposit
PCT	Plant community types
Penrith DCP	Penrith Development Control Plan 2014
Penrith LEP	Penrith Local Environmental Plan 2010
Proposal (the)	The construction of an extension of Links Road to Christie Street

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Proposal footprint (the)	The extent of the land that would be used to construct and operate the Proposal
RNE	Register of the National Estate
SEE	Statement of Environmental Effects
SREP 30	Sydney Regional Environmental Plan No. 30 – St Marys
SSI	State significant infrastructure
SWMP	Stormwater Management Plan
TECs	Threatened ecological communities
TSC Act	*Threatened Species Conservation Act 1995*
WM Act	*Water Management Act 2000*

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1 INTRODUCTION

1.1 OVERVIEW

Maryland Development Company Pty Ltd (Lendlease Communities) is proposing to construct an upgrade and extension of Links Road to connect with Christie Street within St Marys, NSW (the Proposal). Links Road is a local road that currently serves the existing Dunheved Industrial Area and is within the Penrith Local Government Area (LGA). The aim of this road extension is to provide an additional access to the St Marys Development Site (refer to Section 2.1) from Christie Street.

The key components of the Proposal are:

- upgrading the existing Links Road from Dunheved Precinct to Dunheved Golf Club
- extending Links Road to Christie Street
- construction of a new four-way intersection at Christie Street and Lee Holm Road
- utility works and drainage upgrades
- provision of supporting roadside infrastructure including street lighting and signage.

1.2 PURPOSE OF THE REPORT

This Statement of Environmental Effects (SEE) is part of the supporting documentation to the Proposal's development application (DA). It has been prepared in accordance with the Penrith City Council pre-lodgement advice issued on 30 October 2018 and the *DA Submission Requirements* in Appendix F3 of the Penrith Development Control Plan 2014 (Penrith DCP) (Penrith City Council, 2014). This SEE has been prepared to outline the likely impacts of the Proposal, and the proposed measures that would mitigate these impacts.

The Proposal can be assessed under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) given it does not meet the criteria for designated development or state significant infrastructure (refer to Chapter 4). Penrith City Council is the consent authority for this DA. The property is zoned as IN1- General Industrial under the Penrith Local Environmental Plan 2010 (Penrith LEP) and Regional Park and Employment under the Sydney Regional Environmental Plan No. 30 - St Marys (SREP 30).

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2 SITE LOCATION AND CONTEXT

2.1 REGIONAL CONTEXT

The Proposal is located within St Marys, which is approximately five kilometres north-east of Penrith and 45 kilometres west of Sydney CBD. The Proposal would extend from the frontage of the South Dunheved Precinct (within the St Marys Development Site, refer to Figure 2.1), along the existing north-south section of Links Road connecting to Christie Street near the Lee Holm Road intersection. It would provide an additional access point to the St Marys Development Site from Christie Street (refer to Figure 2.2).

The St Marys Development Site covers an area of approximately 1,545 hectares and comprises five precincts including (refer to Figure 2.1):

- Jordan Springs (formerly known as Western Precinct) and Jordan Springs East (formally known as Central Precinct) precincts, which include residential and recreational open space area
- Ropes Crossing (formerly known as Eastern Precinct and Ropes Creek Precinct)
- North Dunheved and South Dunheved precincts, which are zoned for Employment and are located immediately north of the existing Dunheved employment area.

The Precincts are development areas identified under the Sydney Regional Environmental Plan No. 30 – St Marys (SREP 30) that are being constructed by Lendlease.



Figure 2.1 St Marys Development Site precinct locations

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Figure 2.2 Location of the proposal in relation to the St Marys Development site

2.2 LOCAL CONTEXT

2.2.1 PROPOSAL FOOTPRINT

The Proposal footprint (shown on Figure 2.3) is defined as the extent of the land that would be directly used for the construction and operation of the Proposal. It encompasses that land directly impacted by the new road infrastructure as well as the land that may be used by contractors for construction equipment, construction compound locations and laydown areas.

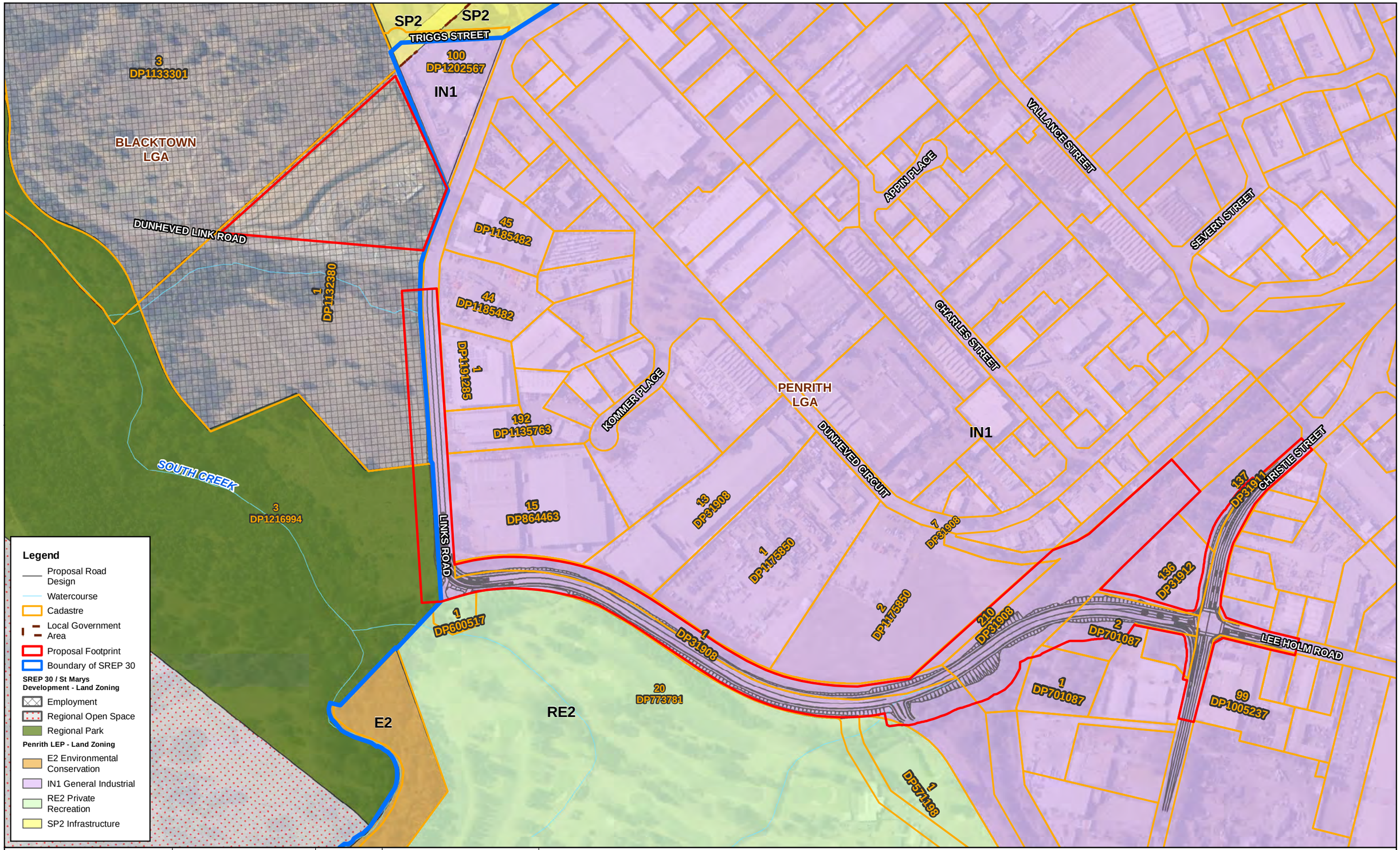
The Proposal footprint includes the lots summarised in Table 2.1 below. A letter of consent for each of the directly impacted lots will be supplied prior to determination of the DA. The directly impacted lots would be acquired by Lendlease Communities (as required) and subdivided as part of the DA process to create an easement for the proposal. Property adjustment and acquisition plans showing the land to be acquired and sub-divided would be provided separately with the DA.

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Table 2.1 Lots directly impacted by the Proposal

LOT/DP	OWNERSHIP	INDICATIVE PROPERTY IMPACT AREA (m^2)	LAND ZONING
Lot 1 DP1132380	St Marys Land Limited	458m^2	Employment (SREP 30)
Lot 1037 DP1149525	St Marys Land Limited	465m^2	Regional Park (SREP 30)
Lot 1 DP31908	St Marys Land Limited	6064m^2	IN1 General Industrial (Penrith LEP)
Lot 210 DP31908	Penrith City Council	Temporary	IN1 General Industrial (Penrith LEP)
Lot 1 DP701087	RMS	Temporary	IN1 General Industrial (Penrith LEP)
Lot 2 DP701087	RMS	4316m^2	IN1 General Industrial (Penrith LEP)
Lot 136 DP31912	Private	375m^2	IN1 General Industrial (Penrith LEP)
Lot 99 DP1005237	SIMS Metal Management	23m^2	IN1 General Industrial (Penrith LEP)
Lot 137 DP31911	Penrith City Council	263m^2	IN1 General Industrial (Penrith LEP)
Lot 1 DP571198	Dunheved Golf Course	Temporary	RE2 Private Recreation (Penrith LEP)
Lot 7 DP31908	St Marys Land Limited	5923m^2	IN1 General Industrial (Penrith LEP)
Lot 15 DP800766	Mid West Transport Services	48m^2	IN1 General Industrial (Penrith LEP)
Lot 136 DP31192	Priard Property Nominees	214m^2	IN1 General Industrial (Penrith LEP)
Lot 1 DP1216778	Priard Property Nominees	Temporary	IN1 General Industrial (Penrith LEP)
Lot 2 DP1216778	Priard Property Nominees	Temporary	IN1 General Industrial (Penrith LEP)

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Links Road Extension - Statement of Environmental Effects

Figure 2.3
Proposal Footprint and Land Zoning

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2.2.2 SITE DESCRIPTION

The Proposal footprint is relatively flat and is located at approximately 20 to 25 mAHD. The land slopes slightly north-west towards South Creek.

The majority of the Proposal extends along the existing Links Road corridor. Links Road is a local road that currently serves the existing Dunheved industrial area, which is characterised by mixed industrial/warehousing development. It has a sealed surface with one lane in each direction. There is a single side kerb and gutter along the portion of the road opposite the St Marys Development site, and no existing kerb and gutter adjacent to Dunheved Golf Course.

The proposed new section of road extends through a disused rail corridor (the rail tracks have previously been removed) and privately-owned land before connecting to Christie Street at its intersection with Lee Holm Road. This section of land features patches of mature vegetation. A drainage line runs south-east through the Proposal footprint. This drainage line connects to South Creek, which is located approximately 500 metres west of the Proposal footprint.

The intersection of Christie Street and Lee Holm Road is currently an unsignalised T-intersection. Christie Street is a regional two-way road that runs east-west from Forrester Road to the Dunheved Road/Werrington Road intersection along the northern boundary of the St Marys employment area. Lee Holm Road is a local two-way road that runs south from Christie Street and provides internal access through the southern part of the St Marys employment area.



Figure 2.4 A view of an existing section of Links Road looking north near the existing 90 degree bend

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Figure 2.5 View of an existing section of Links Road looking northward



Figure 2.6 Example of the bushland near where the new section of Links Road is proposed

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2.2.3 SURROUNDING LAND USES

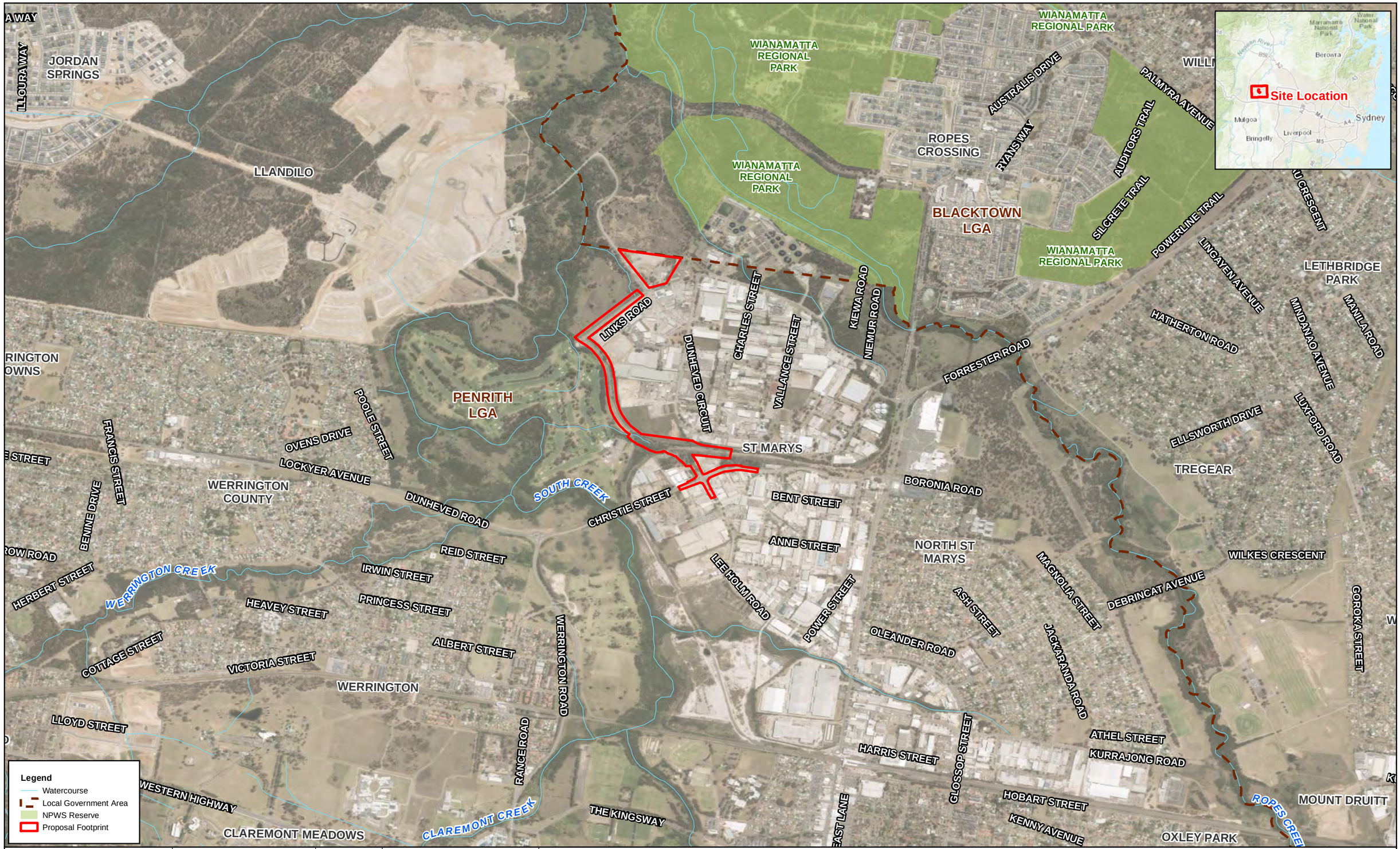
The land uses directly surrounding the Proposal footprint include:

- North: Wianamatta Regional Park, South Creek, future commercial development and local roads associated with the St Marys Development Precinct
- South: Lee Holm Road and industrial developments within the existing Dunheved Industrial area including John and Ricks Smash Repair and Friend Civil Pty Ltd
- East: Industrial development within the existing Dunheved Industrial area including Cardboard King, John Cook & Sons, ITA Australia, Rembrandt Dutch Club St Marys and Jaybro Geosynthetics
- West: Dunheved Golf Club and Kennards Self Storage with South Creek and residential development in Werrington County further beyond.

Other key transportation infrastructure in the area includes:

- the Main Western Railway, located approximately 1.5 kilometres south of the Proposal footprint
- the Great Western Highway, located approximately two kilometres south of the Proposal footprint
- the Werrington Arterial Road, located approximately 2.5 kilometres south of the Proposal footprint
- the M4 Motorway, located approximately four kilometres south of the Proposal footprint.

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Figure 2.7

Existing land uses within and surrounding the Proposal footprint

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3 PROPOSAL DESCRIPTION

3.1 DESCRIPTION OF DEVELOPMENT

3.1.1 KEY COMPONENTS

The key components of the Proposal are (shown on Figure 3.1 and described further in the sections below):

- upgrading the existing Links Road from Dunheved Precinct to Dunheved Golf Club
- extending Links Road to Christie Street
- construction of a new four-way intersection at Christie Street and Lee Holm Road
- utility works and drainage upgrades
- provision of supporting roadside infrastructure including street lighting and signage.

3.1.2 ROAD DESIGN

The road geometry has been designed to comply with the St Marys Planning Agreement, Penrith City Council Design Guidelines for Engineering Works for Subdivisions and Developments, the RMS supplements to Austroads Guide to Road Design, and Austroads Guide to Road Design. This has been conducted in consultation with Penrith City Council engineering representatives, as documented in the DA Pre-lodgement meeting and 50% Concept Design meeting minutes. In the instance of inconsistencies between the standards, the order of hierarchy for the design has been conducted as follows:

1. Penrith City Council Design Guidelines for Engineering Works for Subdivisions and Developments
2. RMS Supplements to Austroads Guide to Road Design
3. Austroads Guide to Road Design.

Table 3.1 shows the road design features that have been adopted in the design for the Proposal.

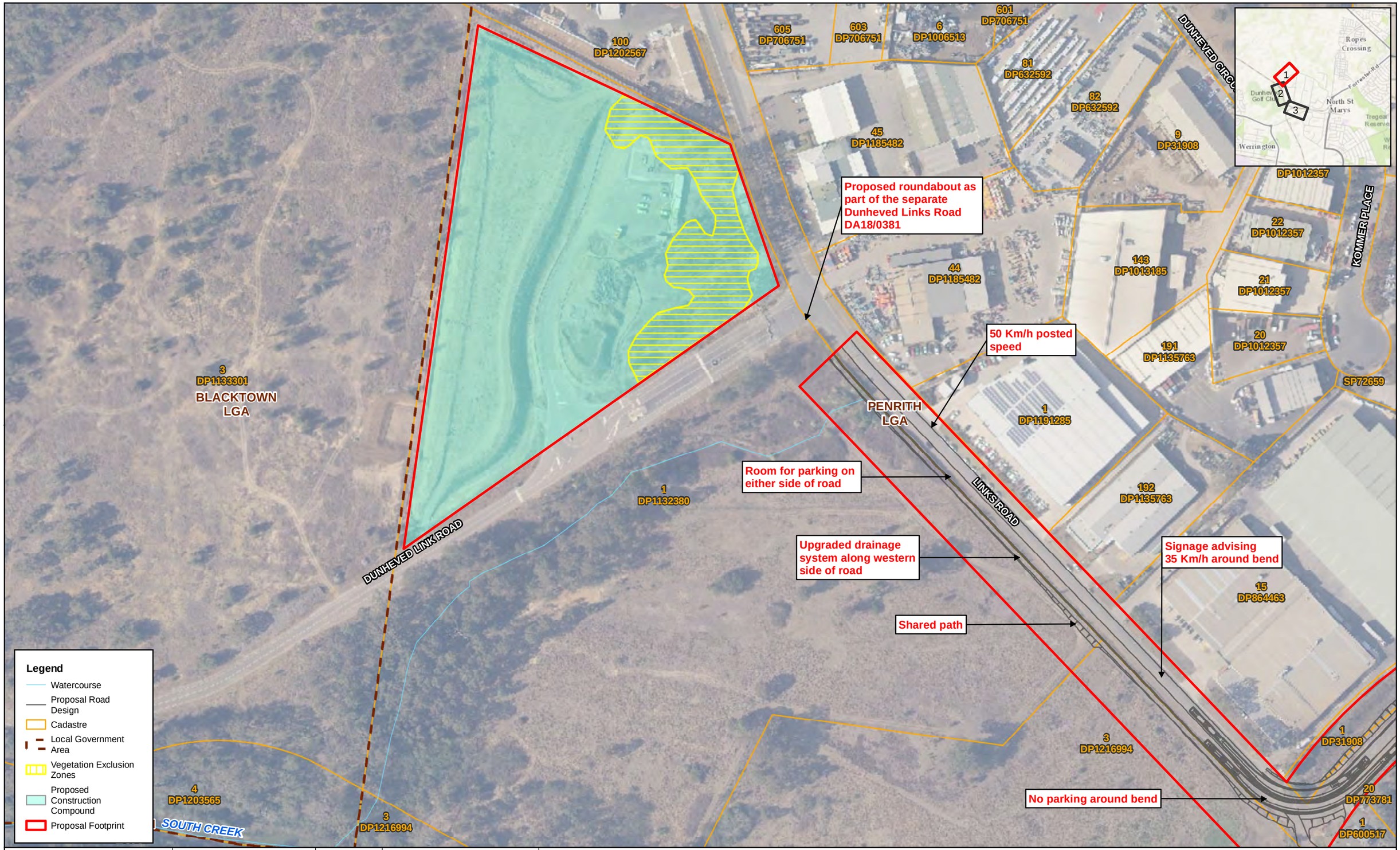
Table 3.1 Design criteria for the road

CRITERIA	DESCRIPTION
Posted speed	Links Road (within the Proposal footprint)– 50 km/h, Christie Street and Lee Holm Road – 60 km/h
Cross section (see Figure 3.2)	One lane in each direction Lane width generally 6.5-7.0 m each lane including room for parking
Design vehicle	Links Road - B-Double (26 m long) Dunheved Golf Course access road – Single unit truck (12.5 m long)

The road design also features (refer to Figure 3.1 and Figure 3.2):

- room for parking along the length of the Proposal, except for the short sections of road near the 90-degree bend, the intersection with Christie Street and Lee Holm Road and the golf course access
- construction of a 2.5 metre shared path for pedestrians/cyclists and provision for a future 1.5 metre wide footpath
- relocation and upgrade of the northbound bus stop on Christie Street to the departure side of the intersection
- widening the existing section of Links Road along the western verge (the existing eastern kerb would be maintained)
- construction of a new unsignalised T-intersection for the Dunheved Golf Club access, and reconstruction of the Sydney Water Pump Station access adjacent to the bend on Links Road
- provision of a 1.2 metre wide median around the 90-degree bend for traffic management and road safety purposes
- construction of a new four-way signalised intersection and the associated road-tie ins at Christie Street and Lee Holm Road (refer to Section 3.1.2.1).

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Figure 3.1
Key Components of the Proposal

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New culvert

1.2m median provided through bend

Access to Sydney Water pumping station adjusted

Sign advising 35 Km/h around bend

New culvert

Disused rail corridor that operates as an existing drainage channel to be retained

Room for parking on either side of road

Upgraded drainage system along western side of road

Provision for future 1.5m footpath in verge

3 DP1216994

SOUTH CREEK

1 DP600517

1 DP234336

20 DP773781

DUNHEVED GOLF COURSE

15 DP864463

20 191 DP1012357 DP1135763

KOMMER PLACE

SP72659

17 DP101239

13 DP31908

1 DP1090461

DUNHEVED CIRCUIT

PENRITH LGA

LINKS ROAD

1 DP1175850

2 DP1175850

1 DP31908

Ropes Crossing

Forester Rd

Dunheved Golf Club

North St Marys

Tregear Reserve

Werrington

1

2

3

Legend

- Landmarks
- Watercourse
- Proposal Road Design
- Cadastre
- Local Government Area
- Vegetation Exclusion Zones
- Proposal Footprint

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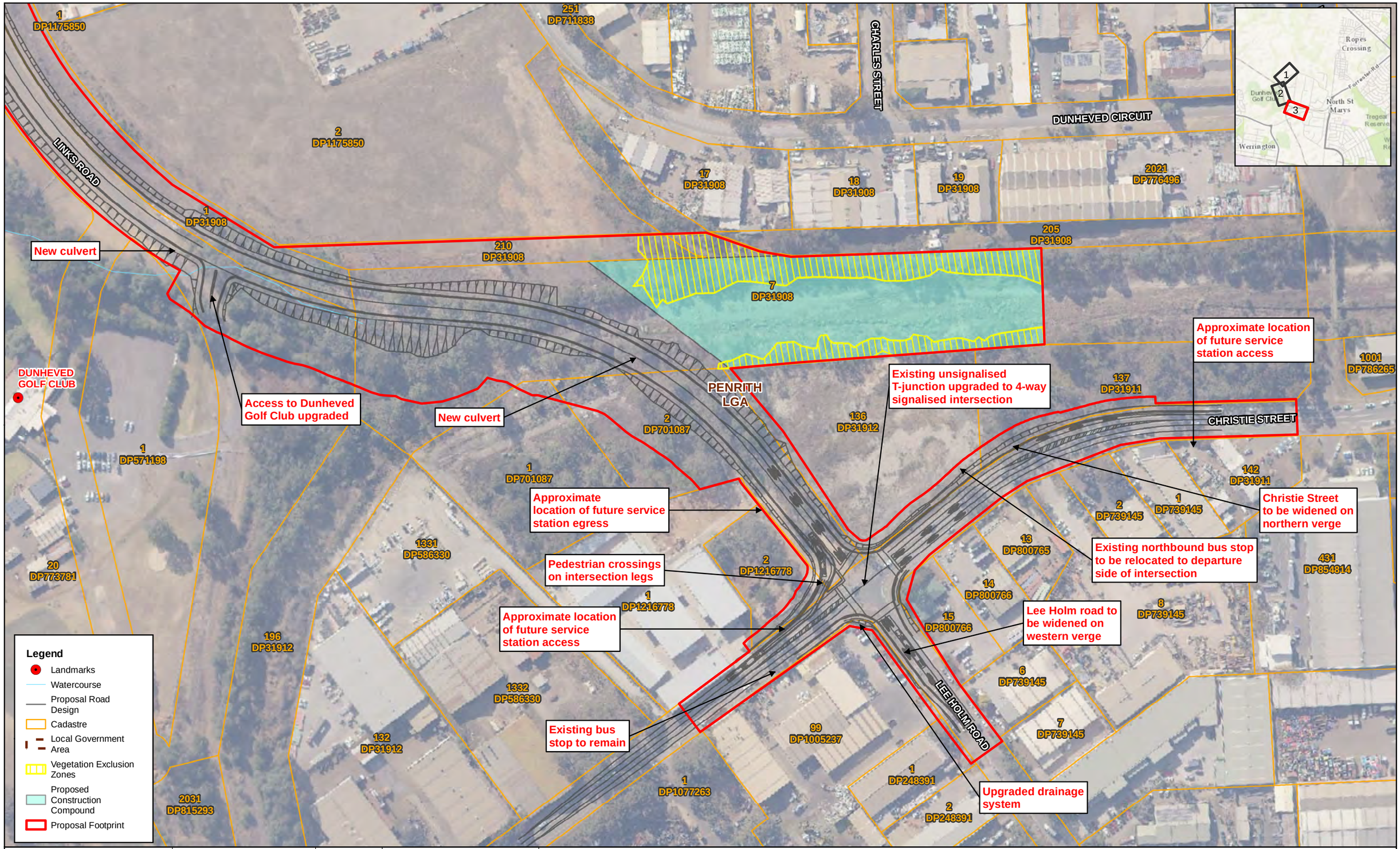
Figure 3.1
Key Components of the Proposal

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Figure 3.1
Key Components of the Proposal

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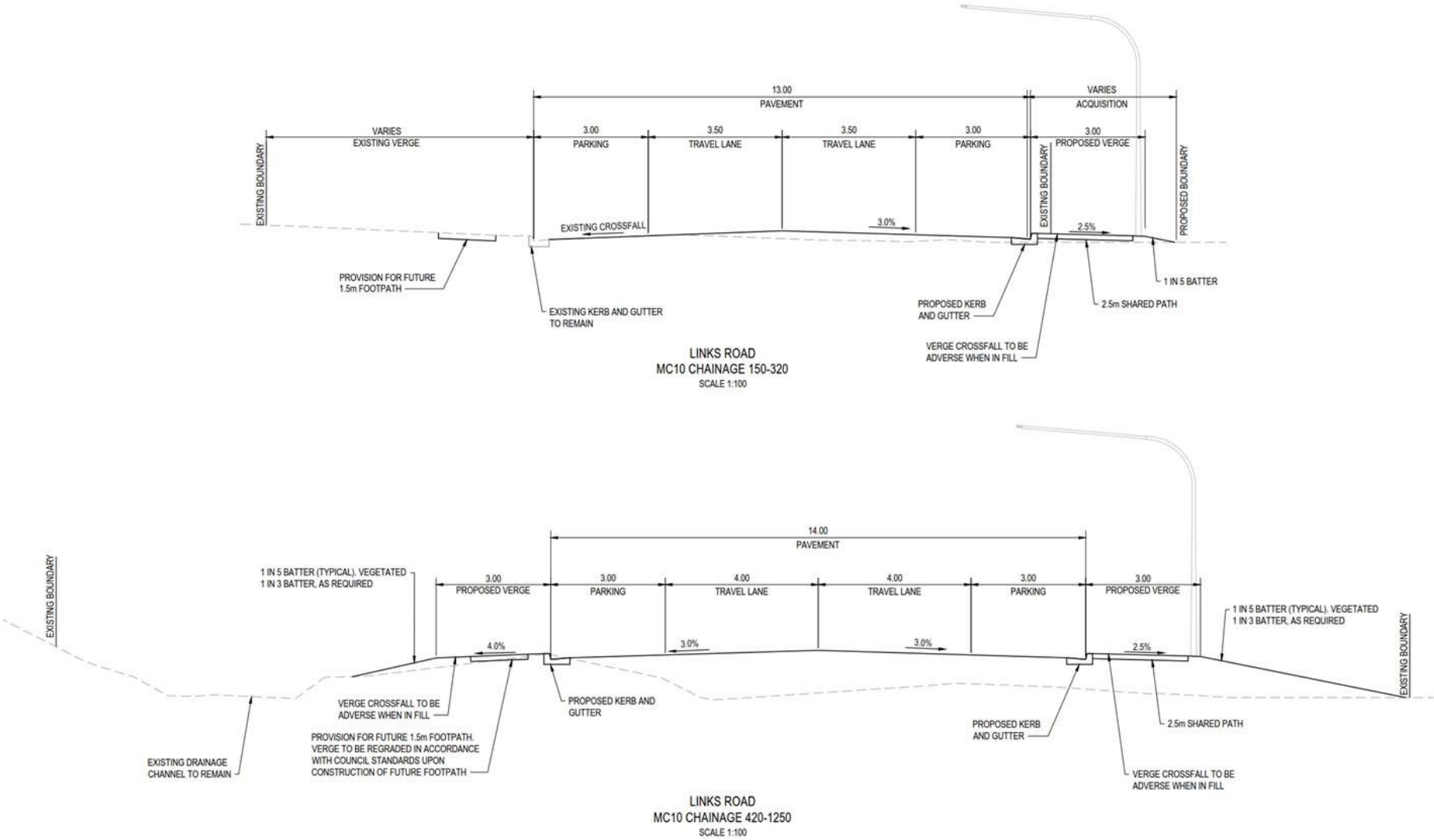


Figure 3.2 Indicative road cross section for the Proposal

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3.1.2.1 INTERSECTION ARRANGEMENT

The Proposal includes construction of a new four-way intersection with Christie Street, Links Road and Lee Holm Road (see Figure 3.3). This intersection would be controlled by new traffic signals (the existing T-intersection at Christie Street and Lee Holm Road currently is uncontrolled). There would be two lanes in each direction on Christie Street on either side of the intersection, which merge into one lane in each direction on near the extent of the Proposal footprint Christie Street . Dedicated right turn lanes would be provided on all approaches to the intersection, except for the west approach. A left-turn slip lane would be provided on the west approach. There would also be pedestrian crossings included on all four legs of the intersection.

Lendlease Communities has and would continue to consult with Roads and Maritime and Penrith City Council in regard to the signalised intersection design. This consultation will be ongoing during detailed design to ensure that the intersection arrangement is satisfactory for both stakeholders.

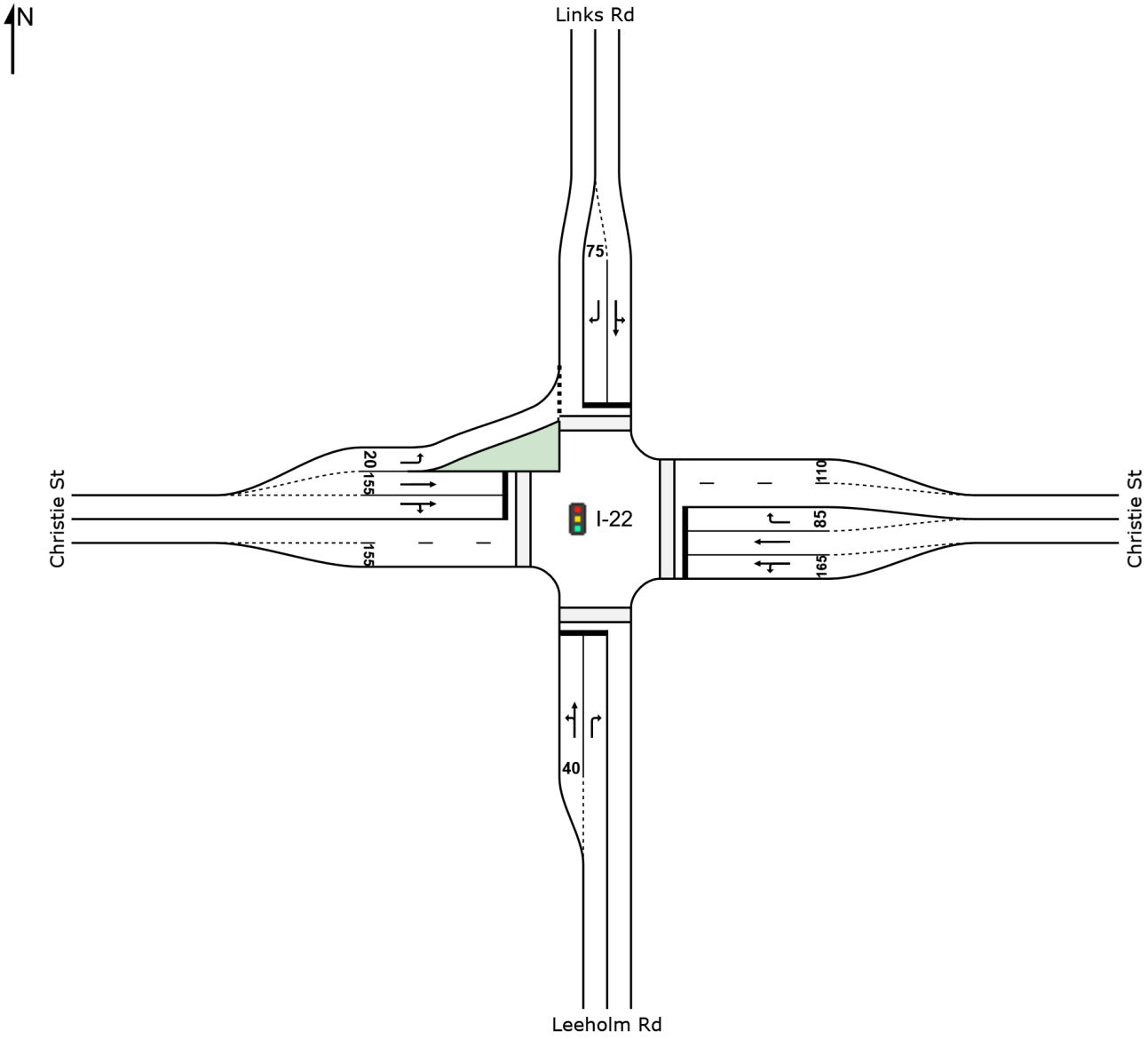


Figure 3.3 Proposed intersection layout at Christie Street/Lee Holm Road/Links Road as modelled in SIDRA (refer to Appendix C)

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The Proposal would directly tie-in to the existing section of Links Road at the northern extent of the Proposal footprint. A future intersection has been proposed at this location as part of the separate Dunheved Links Road project (the DA for the Dunheved Links Road project has been lodged with Penrith City Council and has not been determined (DA18/0381)). However, this intersection with the Dunheved Link Road project will be approved as part of a separate project and is outside the scope of this DA.

3.1.3 UTILITY WORKS AND DRAINAGE

Existing utilities have been identified and located as part of the development of the concept design to incorporate utility authority requirements for relocations and/or adjustments.

Preliminary investigations identified that some public utility assets would be affected by the proposal. Preliminary information was obtained from Dial Before You Dig searches and utilities surveys. Water, gas, electricity and telecommunications infrastructure would be affected by the proposal. Confirmation of the relocation of utilities and associated strategies would be carried out in consultation with utility authorities during detailed design.

Prior to the commencement of works, the location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners. Any proposed utility relocation works would be within the Proposal footprint.

Based on the Updated South Creek Flood Study prepared by WorleyParsons in 2015, flood extents for the section of road between Christie Street and Links Road do not achieve the 20 year ARI flood immunity. In order to meet address this, the road surface water drainage system has been designed to cater for storm events with an average recurrence interval (ARI) of 1-in-20 years and 1-in-100 years. The road design has been undertaken such that if the minor system fails or the capacity is exceeded, a safe escape route for excess flooding is achieved. As part of the drainage work, longitudinal drainage, cross-drainage culverts running under the road and channels would be needed to be maintained and/or upgraded. The indicative locations of the drainage infrastructure proposed are shown on the General Arrangement Plan supplied as part of the DA. Scour protection would be needed at the outlets of all the cross-drainage culverts to prevent erosion and scour. Proprietary water quality devices would be provided at the outlets of the drainage network.

3.1.4 SUPPORTING ROADSIDE INFRASTRUCTURE

The specifics of the supporting road infrastructure including lighting and signage would be confirmed during the detailed design. It would likely include:

- provision of lighting at the Christie Street and Lee Holm Road intersection and along the entirety of the Links Road alignment, designed in accordance with relevant guidelines and standards to minimise light spillage into surrounding properties and minimise glare that could impact on driver visibility
- traffic signals at the Christie Street and Lee Holm Road intersection
- appropriate signage and line marking
- provision of road furniture, as required in accordance with relevant standards and guidelines.

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3.2 CONSTRUCTION METHODOLOGY

3.2.1 KEY CONSTRUCTION ACTIVITIES AND EQUIPMENT

Table 3.2 summarises the likely construction activities and their sequencing for the construction of the Proposal, as well as the plant and equipment that would be likely used to build the proposal. The plant and equipment needed to build the proposal would be typical to any major road construction site. The construction activities and plant and equipment list would be finalised by the contractor following detailed design.

Table 3.2 Indicative construction activities and equipment

ACTIVITY	ASSOCIATED WORK	INDICATIVE EQUIPMENT	
Preparation and enabling	— Obtain leases and licences — Complete property acquisition — Survey the construction site — Relocate fencing — Notify the community and stakeholders — Establish the site compounds and access routes — Fence the site boundaries and areas to be used for stockpile sites — Protect sensitive areas as defined by the construction environmental management plan — Install temporary erosion, sediment and water quality controls, including silt fences, and stormwater diversion drains — Mark trees that would need to be removed or trimmed, and mark any 'no-go' areas — Install traffic management controls including any road closures and diversions — Install noise mitigation measures and safeguards	— Light vehicles — Trucks — Excavators — Generators — Graders — Site sheds	— Back hoes — Water carts — Cranes — Hand tools — Low loaders
Utilities	— Adjust/relocate utility infrastructure (water, gas, electricity and telecommunications) where required.	— Light vehicles — Trucks — Hand tools — Concrete saws	— Generators — Back hoes — Water carts — Elevated work platforms
Surface preparation	— Remove and mulch vegetation in stages along the new road alignment — Strip and stockpile topsoil in stages — Prepare the surface using graders, dozers and other equipment.	— Light vehicles — Trucks — Excavators — Chainsaws — Mulchers — Rollers	— Generators — Back hoes — Water carts — Cranes — Hand tools

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ACTIVITY	ASSOCIATED WORK	INDICATIVE EQUIPMENT	
Earthworks	— Excavate cuttings — Create fill embankments — Place select materials — Construct roadside cuts and fill batters — Prepare batter treatments — Dispose of unsuitable and/or surplus material	— Excavators — Dump trucks — Compactors — Graders — Front-end loaders — Rollers	— Water carts — Profilers — Bulldozers — Vibratory rollers — Rock breakers
Drainage	— Install/extend culverts — Install catch drains — Install scour protection.	— Excavators — Concrete pumps — Concrete trucks — Graders	— Trucks — Bulldozers — Cranes
Road surface	— Gravel base/sub-base layers and asphaltic concrete paving — Apply spray-seal.	— Concrete trucks — Concrete pumps — Vibratory rollers — Compactors — Concrete saws — Compressors — Bitumen sprayers — Batch plants	— Generators — Milling machines — Trucks — Asphalt paving machines — Asphalt trucks — Rollers
Tie in and road markings	— Remove section of old road surface at each intersection and complete road widening and tie-in the new road to existing roads.	— Light vehicles — Trucks — Hand tools	— Generators — Line marking machines
Finishing works	— Conclude property access — Complete tie-ins — Install safety barriers — Install kerbs, gutters and verges — Rehabilitate disturbed areas and landscape — Install line marking, signs and guide posts — Decommission temporary facilities — Clean-up and dispose of all surplus waste — Installation of street lighting and signage.	— Generators — Trucks	— Cranes — Light vehicles

3.2.2 CONSTRUCTION TIMING AND DURATION

It is anticipated that construction would start in 2019 and would take about 10 months to complete. This duration would be subject to approvals, land acquisition, weather and coordinating with other construction activities in St Marys. Construction would be largely carried out in accordance with standard construction working hours:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sundays and public holidays: no work.

To minimise disruption to daily traffic and disturbance to surrounding land owners and businesses, it may be necessary to carry out some work outside of these hours. Prior advice would be given to the community if any work is planned to be carried out outside standard construction working hours. Any work carried out outside of standard working hours would

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be in accordance with the *Interim Construction Noise Guideline* (DECC, 2009) and the *Construction Noise and Vibration Guideline* (Roads and Maritime, 2016).

3.2.3 EARTHWORKS

The proposal would require earthworks to create the required cut and fill profile. Earthworks generally involve removal and temporary stockpiling of suitable material for fill and grading work elsewhere. Movement of materials between work sites would be required, from cutting, to fill and embankment areas, and batter treatments. Table 3.3 provides the indicative bulk earthwork volumes (not including the amount of material to be removed for pavements and channel modifications). The exact earthwork volumes will be determined during detailed design.

Table 3.3 Indicative earthwork volumes

EARTHWORKS	VOLUME ESTIMATE (m^3)
Total cut	11,500
Total fill	13,300

Excavated materials would be managed and stored (stockpiled) in accordance with the Waste Classification Guidelines (DECCW, 2014). This would include the testing and classification of material. Where possible, the excavated material that is suitable for re-use would be used as fill. However, the estimated earthwork volumes indicate that additional fill material may be required to build the proposal. This material would be obtained from local suppliers where possible.

3.2.4 SITE COMPOUNDS

Two site compounds within the Proposal footprint are expected to be required to store equipment, machinery and vehicles during construction of the Proposal. The specific requirements for each site would depend on the stage of construction and the associated work activities.

The main site compound would be located on Lot 1 DP1132380 near the intersection of Dunheved Link Road and Links Road. It is currently used by Lendlease Communities for construction activities. This site may include portable buildings with amenities, such as lunch facilities and toilets, secure and bunded storage areas for site materials, including fuel and chemicals, office space, and associated parking.

A smaller site compound would be established within the abandoned rail line in Lot 7 DP31908, and would be primarily used for facilities such as portaloos and small sheds with minimal land disturbance.

3.2.5 CONSTRUCTION HAULAGE ROUTES

Access to the main site compound and satellite compound is likely to be via Links Road. A review of the Roads and Maritime vehicle restriction map revealed that several routes near the Proposal allow general heavy vehicle access, as indicated in Figure 5.2 below. The likely construction haulage routes comprising of these approved routes would be:

- from/to west: Links Road, Forrester Road, Christie Street and Dunheved Road (or Werrington Road and Great Western Highway)
- from/to east or north: Links Road, Forrester Road, Glossop Street and Great Western Highway
- from/to south: Links Road, Forrester Road, Glossop Street, Great Western Highway and Mamre Road.

It is estimated that there would be less than ten heavy vehicle movements and 50 light vehicle movements associated with the construction of the proposal during weekday AM and PM peak periods. However, this would be subject to the construction methodology and staging proposed by the construction contractor.

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4 COMPLIANCE WITH PLANNING CONTROLS

The following sections take into consideration applicable current and draft environmental planning instruments, development control plans and other legislation relevant to the proposed works. The likely impacts of the proposed works, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality and the suitability of the site for the proposed demolition is addressed under the following sections of this SEE.

4.1 COMMONWEALTH LEGISLATION

4.1.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is designed to protect and manage matters of national environmental significance (MNES) and govern actions undertaken on Commonwealth Land. Under the EPBC Act, a referral is required to the Commonwealth Government for proposed 'actions that have the potential to significantly impact on MNES or the environment of Commonwealth land'. If the proposal is determined to be a 'controlled action' under the Act, then approval from the Commonwealth Minister for the Environment and Energy would be required. The MNES that are protected under the EPBC Act and their relevance to the Proposal are outlined in Table 4.1 below. Overall, no significant impacts on MNES or Commonwealth Land is expected because of the Proposal.

Table 4.1 Consideration of MNES

MNES	CONSIDERATION
World heritage properties	No impact, as there are no world heritage properties near the Proposal.
National heritage places	No impact, as there are no national heritage places near the Proposal.
Wetlands of international importance	No impact, as there are no wetlands of international importance near the Proposal.
Listed threatened species	During field surveys, one EPBC-listed threatened flora species, *Pultenaea parviflora,* was recorded. The Proposal footprint is likely to result in the removal of 30 individuals of this species. However, the significance impact assessment undertaken for this species concluded that the Proposal is unlikely to constitute a significant impact (refer to Section 2.3.5 in Appendix E of Appendix B).
Listed threatened ecological communities (TECs)	Within the Proposal footprint, 0.33 ha of moderate condition Shale Gravel Transition Forest that is listed as Critically Endangered under the EPBC Act was recorded (refer to Section 4.1.1 in Appendix B). However, the significance assessment undertaken in accordance with the *Matters of National Environmental Significance, Significant Impact Guidelines 1.1* concluded that this would not result in a significant impact, so a referral would not be required (refer to Section 1.1.1 in Appendix E of Appendix B).
Migratory species	One migratory species has a moderate likelihood to occur within the Proposal footprint, the Rufous Fantail. However, this species has the potential to utilise a wide variety of habitats and the habitat within the Proposal footprint is unlikely to constitute important habitat or support significant proportions of the population of any migratory species. Therefore, there would not be a significant impact (refer to Section 4.4.4 of Appendix B).

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MNES	CONSIDERATION
Commonwealth marine areas	No impact, as there are no Commonwealth marine areas near the Proposal.
The Great Barrier Reef National Park	No impact, as the Great Barrier Reef National Park is not near the Proposal.
Nuclear actions (including uranium mines)	No impact, as the Proposal does not involve any nuclear actions.
An action on Commonwealth land which is likely to have a significant impact on the environment	No impact, as the Proposal does not impact on any Commonwealth land.
Coal seam gas activities that pose a risk to water resources	No impact, as the Proposal does not involve any coal seam gas activities.

4.2 STATE LEGISLATION

4.2.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979 AND ENVIRONMENTAL PLANNING AND ASSESSMENT REGULATION 2000

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides the framework for the environmental assessment of development in NSW. Its objective is to ensure that potential environmental impacts are properly considered prior to development approval. It is controlled by the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) to regulate and guide development assessment in NSW.

In accordance with Part 3 of the EP&A Act, the Proposal is not considered to be State Significant Infrastructure (SSI) as it is not development specified under Schedules 3, 4 or 5 of the State Environmental Planning Policy (State and Regional Development) 2011.

Schedule 3 of the EP&A Regulation establishes the threshold after which the Proposal, would be considered designated development (e.g. its impacts are sufficient to warrant the need to prepare an Environmental Impact Statement (EIS) over an SEE). The Proposal does involve any development that is described by or meets a threshold for designated development in accordance with Schedule 3 of the EP&A Regulation.

Therefore, as the Proposal is not considered to be SSI or designated development, and a public authority is not the proponent, the appropriate approval pathway for the Proposal is in accordance with Part 4 of the EP&A Act.

The key requirements of Part 4 of the EP&A Act for the assessment and approval of the Proposal are summarised below:

- development consent must be granted in accordance with Penrith LEP (the relevant environmental planning instrument) prior to undertaking any development on the site
- the consent authority (Penrith City Council) must take into consideration the provisions of environmental planning instruments, proposed instruments that are or have been the subject of public consultation under the EP&A Act and have been notified to Penrith City Council, development control plans, planning agreements, regulations and any coastal zone management plans that apply to the site when determining the DA
- the consent authority must consider the likely impacts of the development, suitability of the site, any submissions and the public interest when determining the DA

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- determination of the DA may result in three possible outcomes:
  - granting unconditional consent
  - granting consent subject to conditions
  - refusing consent to the application.

Part 6 of the EP&A Regulation specifies the DA procedure, including how they must be prepared, assessed and approved, or rejected. Part 1, Schedule 1 of the EP&A Regulation also specifies the information to be included in a DA and the documents required to accompany it. For this Proposal, a SEE must accompany the DA because it is development other than designated development or SSI. It also prescribes that the SEE must indicate the following matters:

1. the environmental impacts of the development
2. how the environmental impacts of the development have been identified
3. the steps to be taken to protect the environment or to lessen the expected harm to the environment
4. any matters required to be indicated by any guidelines issued by the Secretary.

This SEE has been prepared to satisfy the above requirements.

4.2.2 BIODIVERSITY CONSERVATION (SAVINGS AND TRANSITIONAL) REGULATION 2017

The *Biodiversity Conservation Act 2016* (BC Act) came into effect on the 25 August 2017. The BC Act repeals the *Threatened Species Conservation Act 1995* (TSC Act), *Native Vegetation Act 2003* and parts of the *National Parks and Wildlife Act 1974* (NPW Act). However, the NSW Government has established transitional arrangements related to biodiversity assessment for the various categories of development consent or approval that are underway or have already been made. These are set out in the Biodiversity Conservation (Savings and Transitional) Regulation 2017. Penrith LGA is classified as an interim designated area under Part 7 Regulation 27 of the Biodiversity Conservation (Savings and Transitional) Regulation 2017. For developments within this interim designated area, former planning provisions continue to apply to pending or interim planning applications that are submitted before 24 November 2018 (NSW Office of Environment & Heritage, 2018).

Therefore, as the development application for the Proposal will be submitted to Penrith City Council before 24 November 2018, the biodiversity assessment for this SEE has been prepared in accordance with the former TSC Act, *Native Vegetation Act 2003* and NPW Act.

4.2.3 OTHER STATE LEGISLATION

Table 4.2 below summarises the other state legislation that may apply to the project.

Table 4.2 Relevant state legislation to the Proposal

LEGISLATION	DESCRIPTION	RELEVANCE TO THE PROJECT
NPW Act	The NPW Act provides for the protection of Aboriginal heritage values, national parks and ecological values. It makes it an offence to harm Aboriginal objects, places or sites without permission.	An Aboriginal heritage impact permit under section 90 of the NPW Act would not be required.
TSC Act	The TSC Act provides for the protection of vulnerable and endangered flora, fauna, communities and populations and their habitat. It makes it an offence to harm terrestrial critical flora and fauna habitat or threatened species, populations and ecological communities and their habitat without an appropriate assessment, inclusion of safeguards and/or the appropriate permissions to carry out certain work.	The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the TSC Act. As such, there is no need to prepare a SIS as per section 109 to section 113 of the TSC Act (refer to Section 5.3 of Appendix B).

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LEGISLATION	DESCRIPTION	RELEVANCE TO THE PROJECT
Heritage Act 1977	The *Heritage Act 1977* provides for the protection of conservation of buildings, works, archaeological relics and places of heritage value through their listing on various State and local registers. The Act makes it an offence to harm any non-Aboriginal heritage values without permission.	A Section 60 application or an excavation permit under Section 139 of the *Heritage Act 1977* would not be required.
Roads Act 1993	Under the *Roads Act 1993,* the consent of the relevant road's authority is required to dig up, erect a structure or carry out work in, on or over a road as well pump water into a public road or connect into a classified road (refer to Section 138 of the Act). For classified roads, the relevant roads authority is Roads and Maritime, and for unclassified roads it is the relevant Council.	The Proposal involves carrying out work in Links Road, Christie Street and Lee Holm Road, which are local roads managed by Penrith City Council. Consent from Penrith City Council under the *Roads Act 1993* would be obtained through the DA process.
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act focuses on environmental protection and provisions for the reduction of water, noise and air pollution and the storage, treatment and disposal of waste. It introduces licencing provisions for scheduled activities that are of a nature and scale that have a potential to cause environmental pollution. Environment Protection Licences (EPLs) are generally required for scheduled activities or scheduled development work. It also includes measures to limit pollution and manage waste.	The definitions of scheduled activities provided in Schedule 1, 35 of the POEO Act includes road construction. However, as the Proposal would not result in a road that has 4 or more traffic lanes, it would not be a scheduled activity.
Water Management Act 2000 (WM Act)	The WM Act aims to ensure sustainable and integrated management of water sources for the benefit of present and future generations. Under Section 91 of the WM Act, an activity approval is required for carrying out a controlled activity at a specified location in, on or under waterfront land (within 40 metres of a mapped watercourse).	The Proposal is a controlled activity within 40 metres of a tributary to South Creek. Therefore, it would be integrated development with the NSW Office of Water. As per Penrith City Council's pre-DA lodgement advice, this would result in a 30-day exhibition/advertising period.

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4.3 ENVIRONMENTAL PLANNING INSTRUMENTS

4.3.1 PENRITH LOCAL ENVIRONMENTAL PLAN 2010

Table 4.3 outlines the matters in the LEP that are relevant to the Proposal and how they have been addressed in this DA.

Table 4.3 Penrith LEP compliance table

SECTION	MATTER	COMPLIANCE ASSESSMENT
Zone IN1 General Industrial	**1. Objectives of zone** — To provide a wide range of industrial and warehouse land uses. — To encourage employment opportunities. — To minimise any adverse effect of industry on other land uses. — To support and protect industrial land for industrial uses. — To promote development that makes efficient use of industrial land. — To permit facilities that serve the daily recreation and convenience needs of the people who work in the surrounding industrial area. **2. Permitted without consent** Nil **3. Permitted with consent** Animal boarding or training establishments; Boat building and repair facilities; Car parks; Depots; Environmental facilities; Environmental protection works; Flood mitigation works; Freight transport facilities; Garden centres; General industries; Hardware and building supplies; Industrial retail outlets; Industrial training facilities; Industries; Kiosks; Landscaping material supplies; Light industries; Neighbourhood shops; Places of public worship; Plant nurseries; Recreation areas; Roads; Rural industries; Self-storage units; Signage; Storage premises; Take away food and drink premises; Timber yards; Transport depots; Truck depots; Vehicle body repair workshops; Vehicle repair stations; Warehouse or distribution centres **4. Prohibited** Hazardous industries; Offensive industries; Any other development not specified in item 2 or 3	The majority of the Proposal is on land zoned as IN1 General Industrial (refer to Figure 2.3). The Proposal satisfies the objectives of this zone as it provides additional access to the surrounding industrial land uses, which promotes industrial development. Under this land zoning, development of roads are permitted with consent.

4.3.2 PENRITH DEVELOPMENT CONTROL PLAN 2014

The Penrith Development Control Plan 2014 (Penrith DCP) supports the implementation of the Penrith LEP 2010 with more detailed planning and design guidelines. The sections of the Penrith DCP that apply to the Proposal and how the guidelines have been considered are outlined in Appendix A.

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4.3.3 SYDNEY REGIONAL ENVIRONMENTAL PLAN NO 30 – ST MARYS

Table 4.4 outlines the matters in the Sydney Regional Environmental Plan No. 30 – St Marys (SREP 30) that are relevant to the Proposal and how they have been addressed in this DA.

Table 4.4 Penrith DCP compliance table

SECTION	MATTER	COMPLIANCE ASSESSMENT
Part 4 Clause 19 Consent Authority	**1** For the purposes of this plan, the consent authority for development applications relating to land to which this plan applies is the Council of the City of Penrith, if the land is within the City of Penrith, or the Council of the City of Blacktown, if the land is within the City of Blacktown.	This clause confirms that Penrith City Council are the appropriate consent authority for the DA, including for land zoned under SREP 30.
Part 5 Clause 22 Ecologically sustainable development	Development on the land to which this plan applies is to be planned and carried out so that it supports the goal of ecologically sustainable development within the region declared under the Act and known as the Sydney Region.	Section 7.2 discusses how the Proposal supports the goal of ecologically sustainable development in accordance with the Act.
Part 5 Clause 23 Air Quality	**1** Adverse impact on the air quality of the Blacktown City and Penrith City local government areas is to be minimised through the implementation of appropriate measures as part of any development. **2** Development on the land to which this plan applies should contribute to improved regional air quality by containing growth in vehicle kilometres travelled, by achieving higher than normal public transport use, encouraging walking and cycling, and promoting energy-efficient businesses and homes.	During construction of the Proposal, air quality impacts would be managed through the implementation of sediment and erosion control measures (refer to Chapter 6). The Proposal includes provision of a shared path to encourage walking and cycling. It also provides an additional access road, which may reduce the travel distance (and hence the vehicle kilometres travelled) for some road users.
Part 5 Clause 24 Conservation	**1** A representative and significant proportion of the natural values of the land are to be conserved within a regional park in order to protect the variety of Western Sydney vegetation communities, native flora and fauna species and fauna habitat. **2** Urban design and site planning in the Employment and Urban zones are to have regard to significant stands of trees and, where practicable, retain those trees. **3** Adverse impacts on the vegetation and fauna habitats within the Regional Park and Regional Open Space zones resulting from the development of areas zoned Employment or Urban are to be minimised. **4** Infrastructure is to be designed and located to minimise potential adverse impacts on the conservation values of the land. **5** Infrastructure and recreational facilities within the regional park are to be sited and constructed to minimise adverse impact on the park's natural values.	The portion of regional park within the Proposal footprint consists of a miscellaneous ecosystem (high disturbed areas with no or limited native vegetation) (refer to Figure 3.2 in Appendix B). Where practicable, trees would be retained within the Employment zone. Therefore, there would be minimal adverse impacts on the vegetation and fauna habitats and the conservation values of the land associated with the Proposal.

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SECTION	MATTER	COMPLIANCE ASSESSMENT
Part 5 Clause 25 Heritage	**2** Development is not to adversely affect the heritage significance of items of environmental heritage and their settings.	Site 1 - Dunheved Homestead is a Non-Aboriginal Item of Heritage within the Proposal footprint. However, the Proposal is unlikely to adversely affect the heritage significance of this item (refer to Section 5.2.2).
Part 5 Clause 28 Watercycle	**1** During and following construction, impacts upon water quality are to be minimised, through the utilisation of effective erosion and sediment control measures in accordance with industry standards. **2** The use of the land to which this plan applies is to incorporate stormwater management measures that ensure there is no net adverse impact upon the water quality (nutrients and suspended solids) in South Creek and Hawkesbury-Nepean catchments. **4** Development is to be designed and carried out so as to ensure that there is no significant increase in the water table level and that adverse salinity impacts will not result. **5** There is to be only minimal impact upon flood levels upstream or downstream of the land to which this plan applies as a consequence of its development. **6** Drainage lines are to be constructed and vegetated so that they approximate as natural a state as possible. Where it is necessary to modify existing drainage lines to accommodate increased stormwater runoff from urban areas, this should be done in a manner which maximises the conservation of indigenous flora in and around the drainage lines. **7** Development is to be carried out in a manner that minimises flood risk to both people and property. **8** Changes in local flow regimes due to development are to be minimised for rainfall events up to the 50% AEP rainfall event. **9** Gross pollutants are to be collected at, or as close as possible to, their source or at all stormwater outlets, or at both of those places, so that there is no increase in sediment/litter entering the creeks as a result of development.	Erosion and sediment control measures in accordance with industry standards would be implemented during construction of the Proposal (refer to Chapter 6). These will be outlined on an erosion and sediment control plan (ESCP) that will be lodged separately as part of the DA. A high-level description of the drainage to be implemented as part of the Proposal is provided in Section 3.1.3. A stormwater concept plan will also be lodged as part of the DA that will show the stormwater management measures to minimise surface water impacts and flood risk.
Part 5 Clause 29 Soils	Development is to have regard to soil constraints to ensure that the risk of adverse environmental and economic impacts is minimised.	Soil constraints have been discussed in Section 5.1.1.

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SECTION	MATTER	COMPLIANCE ASSESSMENT
Part 5 Clause 30 Transport	**1** Development should support creation of effective public transport and bicycle links to the dominant centres and major transport nodes in the Blacktown City and Penrith City local government areas. **4** Development of the land to which this plan applies is to effectively link that land into the surrounding road network and traffic generated by the development is to be catered for at a satisfactory level of service. **5** Provision of transport infrastructure and services is to be coordinated with the staging of development on the land.	The Proposal includes provision of a shared path that would support the creation of bicycle links within Penrith LGA. It also includes an upgrade to an existing section of Links Road and the intersection at Christie Street and Lee Holm Road. This would help cater for traffic generated, and support the staging, of surrounding development (refer to Section 5.1.1).
Part 6 Clause 37 Regional Park Zone	**1** The objectives of the Regional Park zone are: **a** to identify land that is to be or is reserved or dedicated under the *National Parks and Wildlife Act 1974* (NPW Act), and **b** to conserve and enhance the range and variety of ecological communities, native flora and fauna species and plant and animal habitats within the area, and **c** with regard to the views of local Aboriginal communities, to conserve the Aboriginal values of the area to ensure they are available for interpretation to future generations, and **d** to provide recreational facilities that are consistent with the natural and cultural values of the land to which this plan applies. **2** In the Regional Park zone: **a** development for the purpose of any land use authorised by or under the NPW Act and any land use ordinarily incidental or ancillary to any such land use may be carried out without development consent, and **b** any other development is prohibited.	The portion of land zoned as Regional Park within the Proposal footprint consists of a miscellaneous ecosystem (high disturbed areas with no or limited native vegetation) (refer to Figure 3.2 in Appendix B). There are also no known Aboriginal values within the Proposal footprint (refer to Figure 4.2 in Appendix E). In addition, the proposed development within the Regional Park zone is minimal and would consist of a grassed verge and batter and street lighting (refer to Figure 3.1 and Figure 3.2). This would not prevent use of the land as a recreational facility. As per Clause 47O(8) of the *NPW Act*, " a local council nominated under subsection (3)(c)(iii) by the Minister: **a** has, subject to this Act, the care, control and management of the regional park concerned, and **b** has the powers and functions conferred and imposed on it by or under this Act, and **c** is, in the exercise of such powers and functions, subject to the control and direction of the Minister." Penrith City Council has been consulted in regard to the proposed development within the Regional Park Zone to fit the required road widening along Links Road.

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SECTION	MATTER	COMPLIANCE ASSESSMENT
Part 6 Clause 39 Employment Zone	**1** The objectives of the Employment zone are: **a** to provide land for employment-generating land uses in locations which are compatible with surrounding development and which are accessible from within and outside the land to which this plan applies, and **b** to provide for a wide range of employment development on land which will complement established employment areas and retail and commercial centres in the Blacktown City and Penrith City local government areas, and **c** to accommodate uses which generate business activity and employment opportunities in the Blacktown City and Penrith City local government areas, and **d** to ensure that development adjacent to the Regional Park zone does not have a negative impact on the biodiversity or conservation values of land within that zone. **2** In the Employment zone: **a** any development (except that identified by this plan as exempt or by paragraph (b) as prohibited) is allowed only with the consent of the consent authority, and **b** development for the purpose of the following is prohibited: agriculture, airline terminals, amusement centres, bed and breakfast establishments, bulky goods retailing, caravan parks, commercial premises (except where ancillary to buildings or land uses not specified in this paragraph), educational establishments (other than colleges, technical colleges, academies or lecture halls), exhibition homes, exhibition villages, extractive industries, forestry, generating works, hazardous industries, hazardous storage establishments, helipads, heliports, hospitals, hotels, housing (except where ancillary to buildings or land uses not specified in this paragraph), institutions, intensive livestock keeping establishments, intensive plant agriculture, liquid fuel depots, local retail or commercial premises, mines, mineral sand mines, nursing homes, offensive industries, offensive storage establishments, roadside stalls, rural industries, sawmills, shops (including a retail shop which is ancillary or incidental to another form of	The Proposal is aligned with the objectives of the Employment zone as it would provide upgraded access to the employment development. It would also not have a negative impact on the biodiversity or conservation values of land within the adjoining Regional Park Zone. Under this land zoning, road development is allowed with the consent of Penrith Council.

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SECTION	MATTER	COMPLIANCE ASSESSMENT
	development but not including shops which serve the daily convenience needs of the workforce employed within the zone), stock and sale yards, timberyards, waste disposal.	
Part 7 Clause 44 Consultation with National Parks and Wildlife Service	**1** This clause applies to the following: **a** development of land adjoining land within the Regional Park zone, and **b** development for the purpose of a road or public utility undertaking on land zoned Regional Park that is subject to an existing easement, where the application is lodged prior to the land being reserved or dedicated under the *National Parks and Wildlife Act 1974*. **2** The consent authority must not grant development consent for development unless it has referred a copy of the development application to the Director-General of National Parks and Wildlife. **3** Where a copy of a development application has been forwarded to the Director-General of National Parks and Wildlife pursuant to this clause, the consent authority must not grant consent to the application until: **a** it has received and considered advice with respect to the application from that Director-General, or **b** the consent authority has been notified that that Director-General does not wish to submit any advice with respect to the application, or **c** 28 days have elapsed after the date on which the application was referred to the Director-General, whichever occurs first.	Penrith City Council would forward the DA to the National Parks and Wildlife prior to granting development consent. Lendlease Communities have started consultation with the Office of Environment and Heritage (OEH) in regard to the proposed development within the Regional Park zone.
Part 7 Clause 49 Land below the PMF level	**5** Road systems on land which would be affected by the PMF are to be designed to facilitate safe evacuation during flood events	The road surface water drainage system has been designed to cater for minor storm events with an average recurrence interval (ARI) of 1-in-20 years and major storm events with an ARI of 1-in-100 years. The road design has been undertaken such that if the minor system fails or the capacity is exceeded, a safe escape route for excess flooding is achieved.

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SECTION	MATTER	COMPLIANCE ASSESSMENT
Part 7 Clause 50 Filling of land	**1** Filling of land that is below the level of the PMF before it is filled is prohibited. **2** However, the consent authority may grant consent to the filling of land where it is satisfied that: **a** the proposed development will not be inconsistent with the principles set out in the manual entitled Floodplain Development Manual: the management of flood liable land published by the New South Wales Government, and **b** in the case of land identified on the Structure Plan as "potential fill area", the proposed development will not be inconsistent with the performance objectives of this plan, and **c** in the case of land not identified on the Structure Plan as "potential fill area" but within the Regional Open Space zone or the Road and Road Widening zone, the proposed development is necessary as part of development to be carried out on the land.	The earthwork requirements for construction of the road would be confirmed during detailed design. Indicative cut and fill values are provided in Table 3.3. If any filling of land below the PMF is required for the road construction, it would be designed so that it would be consistent with the performance objectives and floodplain principles.
Part 7 Clause 51 Salinity and highly erodible soils	**1** The consent authority must not grant consent to the development of any land unless it has considered: **a** a detailed soil assessment which includes a finding of whether or not the land is at risk from salinity or contains soils which are highly erodible, and **b** whether the proposed development incorporates appropriate building materials, techniques and land management measures to mitigate adverse environmental and economic impacts. **2** The consent authority must not consent to the development of land so found to be at risk or affected, unless it is satisfied that appropriate measures have been incorporated or are able to mitigate the potential impacts.	Section 5.1.1 presents a soil assessment for the Proposal, including the salinity risk and likely soil conditions. Further geotechnical testing would be undertaken during detailed design. This would ensure that the building materials and techniques proposed are appropriate for the site context. Section 6 outlines measures to mitigate the potential impacts of the Proposal.
Part 7 Clause 54 General heritage conditions	Consent must not be granted for development of, or in the vicinity of, an item of environmental heritage unless the consent authority has made an assessment of the effect the carrying out of that development will have on the heritage significance of the item and its setting.	An assessment of the heritage impacts of the Proposal is provided in Section 5.2.2. Further heritage assessment is provided in Appendix E.
Part 7 Clause 55 Conservation of items of environmental heritage	**1** A person must not, in respect of a building, place, work or relic that is an item of environmental heritage: **a** demolish, renovate or extend the building or work, or **b** damage or despoil the relic or any part of the relic, or	An assessment and statement of the heritage impacts of the Proposal is provided in Section 5.2.2. Further heritage assessment is provided in Appendix E.

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SECTION	MATTER	COMPLIANCE ASSESSMENT
	c excavate any land for the purpose of exposing or removing the relic, or **d** erect a building on the land on which the building, work or relic is situated or the land which comprises the place, or **e** subdivide the land on which the building, work or relic is situated or the land which comprises the place, except with the consent of the consent authority. **2** The consent authority must not grant consent to a development application made in pursuance of subclause (1) unless it has made an assessment of: **a** the significance of the item as an item of environmental heritage of the St Marys area, and **b** the extent to which the carrying out of the development in accordance with the consent would affect the historic, scientific, cultural, archaeological, architectural, natural or aesthetic significance of the item and its site, and **c** whether the setting of the item and, in particular, whether any stylistic, horticultural or archaeological features of the setting should be retained, and **d** whether the item constitutes a danger to the users or occupiers of that item or to the public. **3** The consent authority must not consent to development involving an item of environmental heritage unless it has considered a statement of heritage impact or a conservation plan relating to the item and the proposed development. **4** The consent authority may grant consent to development involving the excavation or filling of land or the erection on land (involving disturbance of the land) or demolition of buildings on land that is the site of an item of environmental heritage that is of non-Aboriginal heritage significance only if it has considered a statement of heritage impact or a conservation plan relating to the item and the proposed development.	

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4.3.4 OTHER STATE ENVIRONMENTAL PLANNING INSTRUMENTS:

As per Penrith City Council's pre-DA lodgement meeting minutes, the following State environmental planning instruments are relevant to consider for the Proposal:

- State Environmental Planning Policy (State and Regional Development) 2011, which outlines a range of triggers beyond which a development would be classed as 'regionally significant development'. Under Schedule 7, Clause 3, the Proposal would be classed as regionally significant development as it is a council related development that has a capital investment value of more than $5 million.
- Sydney Regional Environmental Plan No 20 – Hawkesbury Nepean River (No 2 – 1997), which outlines a range of general planning considerations, policies and strategies for Penrith City Council (as the consent authority) to consider when assessing the application.
- State Environmental Planning Policy No 55 – Remediation of Land, which provides for a NSW planning approach to the remediation of contaminated land. The potential for contamination within the Proposal footprint is discussed in Section 5.1.1.
- State Environmental Planning Policy (Infrastructure) 2007, which outlines the development consent required for different infrastructure projects within NSW. In accordance with Division 17, the Proposal is not able to be carried out without consent or as exempt development.

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5 ASSESSMENT OF LIKELY IMPACTS OF THE PROPOSAL

The following Chapter summarises an assessment of likely impacts of the proposal including any:

- impacts on the natural environment – water, biodiversity, soil erosion, air quality and sedimentation
- impacts on the built environment – heritage, landscape character, visual
- the likely social and economic impacts in the locality, traffic and noise.

The key issues are the environmental management assessment areas which were identified by Penrith City Council in their pre-DA lodgement meeting minutes.

5.1 KEY ISSUES

5.1.1 SOIL AND CONTAMINATION

This section has been informed by an Environmental Site Assessment undertaken by JBS&G for the Proposal (provided in Appendix F). This assessment included completing a detailed site investigation (DSI) in accordance with NSW EPA guidelines and relevant Australian Standards including National Environment Protection (Assessment of Site Contamination) Measure 2013 (NEPM 2013).

5.1.1.1 EXISTING SOIL AND POTENTIAL FOR CONTAMINATION

SOIL PROFILE

The soil profile across the Proposal footprint generally comprises silty gravelly clay fill material (from the surface to a maximum depth of 0.8 mBGL) underlain by natural red/brown to grey mottled silty clay (JBS&G, 2018).

A review of regional soil mapping indicates that the Proposal footprint is within the (OEH, 2017):

- South Creek soil landscape for the majority of the existing section of Links Road
- Berkshire Park soil landscape from the existing section of Links Road to the intersection with Christie Street and Lee Holm Road.

The South Creek soil landscape is characterised by floodplains, valley flats and drainage depressions with quaternary alluvium derived from Wianamatta Group shales and Hawkesbury Sandstone. The typical limitations associated with this soil landscape include flood hazard, seasonal waterlogging as well as localised permanently high watertables, water erosion hazard and surface movement potential.

The Berkshire Park soil landscape is characterised by dissected, gently undulating low rises on the Tertiary terraces of the Hawkesbury/Nepean River system and weakly pedal orange heavy clays and clayey sands. The typical limitations associated with this soil landscape include very high wind erosion hazard if cleared as well as localised seasonal waterlogging, flood hazard, impermeable subsoils and low fertility.

SALINITY

According to the Salinity Potential in Western Sydney 2002 map, the Proposal footprint is within land mapped as having moderate salinity potential. In these areas, “scattered areas of scalding and salinity indicator plants have been noted but no concentrations have been mapped” (Department of Land and Water Conservation, 2002).

ACID SULFATE SOILS

According to the CSIRO Australian Soil Resource Information System, the Proposal footprint is within land classed as C4 – extremely Low Probability/very low confidence for acid sulfate soils (CSIRO, 2014). This means that acid sulfate soils are highly unlikely to be encountered within the Proposal footprint.

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CONTAMINATION STATUS

A search of the EPA's contaminated land register showed that there are no known notices issued under the *Contaminated Land Management Act 1997* for the site.

The DSI found that the greatest potential for encountering contamination within the Proposal footprint would be associated with (refer to Appendix F):

- stockpiles of dumped rubbish with some fragments of asbestos containing material (ACM), which were observed to occur particularly within the southern portion of the Proposal footprint (refer to Table 2.2 in Appendix F)
- historical spillage of soils and fuels on the ground from the existing use of the Proposal footprint as a road.

However, no physical indicators of contamination or asbestos were observed beneath the ground surface during test pitting or soil sampling. Additionally, the soil samples collected during the DSI were analysed for a number of potential contaminants of concern, including heavy metals, hydrocarbons, pesticides and asbestos. The statistical analysis of the soil results found that there were no exceedances of the adopted health and ecological assessment criteria. Therefore, the existing soil beneath the ground surface was considered to be free of any contamination that may present an unacceptable health risk.

Therefore, it was concluded that the existing condition of the Proposal footprint would be suitable for its proposed use as a road and no remediation would be required. However, it was recommended that the stockpiles of dumped rubbish (including the ACM) should be removed from the Proposal footprint during construction.

5.1.1.2 POTENTIAL IMPACTS DURING CONSTRUCTION

The expected bulk earthwork volumes for the Proposal would be about 11,500 m^3 of cut material and 13,300 m^3 of fill material (refer to Section 3.2.3). This would involve temporary stockpiling of soil at its point of excavation and its longer-term storage at the main site compounds (refer to Section 3.2.4). Vegetation clearing, tree removal and other earthwork activities would also be required during construction of the Proposal. These activities could potentially lead to:

- washout, erosion and sediment discharge of exposed soils
- dust generation
- loss of soil quality and condition during stockpiling
- soil contamination through accidental fuel and/or chemical leaks or spills.

However, these potential soils impacts would be mitigated and/or avoided through implementation of standard erosion and sediment controls as well as procedures for storage and handling of hazardous materials and operation of machinery (refer to Chapter 6).

The DSI results suggest that the risk for encountering contamination and acid sulfate soils within the Proposal footprint is low, except for the fragments of ACM within the stockpiled rubbish. Therefore, the potential impacts associated with encountering and/or spreading contamination during construction of the Proposal would be minor, provided that the ACM material would be appropriately removed as 'special (Asbestos) waste' material by a licenced waste contractor.

5.1.1.3 POTENTIAL IMPACTS DURING OPERATION

The following impacts are typical of any operational road and may result in some contamination impact to the soils:

- chemical and fuel spillage from road traffic, maintenance or accidents
- runoff of oils, greases and hydrocarbons from the road.

However, this impact would be minor and consistent with the existing contamination within the Proposal footprint from the existing roads.

The soil landscapes within the Proposal footprint have high potential for erosion, particularly with vegetation removal. However, the proposed new road surface would be sealed and the existing vegetation surrounding the new road would

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generally be retained. Therefore, there would not be any additional soil erosion impacts from the operation of the Proposal, as there would not be a notable increase in the area of exposed ground surface.

5.1.2 NOISE AND VIBRATION IMPACTS

This section has been informed by an acoustic assessment of the Proposal undertaken by RCA Australia (provided in Appendix D). This assessment was prepared in accordance with the:

- *Road Noise Policy* for operational noise impacts (Department of Environment Climate Change & Water, 2011)
- *Interim Construction Noise Guideline* for construction noise impacts (Department of Environment & Climate Change, 2009)
- British Standard BS 7385 and *Assessing Vibration: A Technical Guideline* (Department of Environment & Conservation, 2006) for vibration impacts.

5.1.2.1 EXISTING ACOUSTIC ENVIRONMENT

Sensitive receivers surrounding the Proposal footprint were grouped into representative noise catchment areas (NCAs) based on their existing acoustic environment. Figure 5.1 shows the NCAs identified for the acoustic assessment as well as the locations where the unattended noise monitoring (circle), attended monitoring (star) and traffic count (triangle) was carried out. It also shows the residential regions (shaded blue), recreational areas (shaded orange) and industrial areas (shaded purple) surrounding the Proposal footprint.

The results of the noise monitoring are presented in Sections 4.2.1 and 4.2.2 in Appendix D. It showed that the background noise levels were largely determined by existing traffic on the road network and varied between NCAs, with the levels being significantly lower at M1 than at M2.

The noise monitoring results were used to develop construction and operational noise criteria for the identified sensitive receivers (refer to Chapter 5 in Appendix D).

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Figure 5.1 Location of the NCAs surrounding the Proposal footprint

5.1.2.2 POTENTIAL IMPACTS DURING CONSTRUCTION

During construction of the Proposal, noise would be generated by use of equipment and vehicle movements associated with construction activities. The construction activities considered in the noise modelling included (refer to Section 3.2.1):

- Activity 1: Preparation and Enabling
- Activity 2: Utilities
- Activity 3: Surface preparation
- Activity 4: Earthworks
- Activity 5: Drainage
- Activity 6: Road surface
- Activity 7: Tie-in and road markings
- Activity 8: Finishing works
- Activity 9: General compound operation.

As the Proposal footprint is large, multiple construction activities may occur simultaneously and at different locations. Therefore, worst-case scenarios were developed for the construction noise modelling to determine the maximum impacts that may occur. The scenarios were determined by choosing the combinations of construction activities and construction locations that generated the greatest noise impacts, both in terms of absolute noise levels and greatest number of impacted receivers. Table 5.1 outlines the construction scenarios modelled.

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Table 5.1 Construction scenarios modelled for potential noise impacts

SCENARIO	TIME	ACTIVITY LOCATION	ACTIVITIES OCCURRING
1	Day	Worst-case for residential receivers	Activities 2-7 and 9
2	Day	Worst-case for Dunheved golf course	Activities 2-7 and 9
3	Day	N/A	Activities 1 and 9
4	Day	N/A	Activities 8 and 9
5	Night	Worst-case for residential receivers to the north-west	Activities 2 and 9
6	Night	Worst-case for residential receivers to the east and west, including works at Christie Street	Activity 2
7	Night	Worst-case for residential receivers to the east and west, including works at Christie Street	Activity 3
8	Night	Worst-case for residential receivers to the east and west, including works at Christie Street	Activity 4
9	Night	Worst-case for residential receivers to the east and west, including works at Christie Street	Activity 5
10	Night	Worst-case for residential receivers to the east and west, including works at Christie Street	Activity 6
11	Night	Worst-case for residential receivers to the east and west, including works at Christie Street	Activity 7

The noise modelling showed that the adopted construction noise criteria would be exceeded for some of the identified receivers in the majority of construction scenarios. Construction noise impacts may extend up to 1050 metres away from the Proposal footprint at night time, depending on topography and shielding effects. Section 7.3 in Appendix D presents the predicted noise levels for all NCAs and scenarios as well as a full summary of results.

In general, Scenarios 1 and 2 generated the most noise. The noisiest individual activities were earthworks and surface preparation, followed by drainage and road surfacing. NCA 1 is expected to be the worst affected residential NCA during daytime works, although NCA 2 may experience higher noise levels than NCA 1 depending on the location of works. This is due to the proximity of both NCAs to the site, the lack of screening structures to mitigate sound, and the low existing background noise levels in both areas. NCA 8 would also be affected by the noise generated from construction works across the full length of the Proposal footprint. The maximum predicted exceedances of the adopted noise criteria were 8 dB for residential receivers in NCA 1 during Scenario 1, and 14 dB at the golf course in NCA 8 during Scenario 2.

During night works, the nosiest scenario was Scenario 8 (earthworks at the Christie Street intersection). NCA 1 or NCA 2 may be the worst affected NCAs for utilities work, depending on the location of the works along the Proposal footprint. During night works at the Christie Street intersection, NCA 2 and NCA 4 would be the worst affected NCAs. NCA 4 is due to the proximity of the works to the closest residences; NCA 2due to the low existing background noise in the area. The maximum predicted exceedance of the adopted noise criteria was 10 dB for NCA 1 during Scenario 5.

However, these predicted noise impacts on surrounding receivers are conservative and would be temporary for the duration of the construction works. Mitigation measures would be implemented to minimise noise impacts during construction (refer to Chapter 6).

No vibration impacts on surrounding receivers are expected during construction due to the large distance to the closest residential receiver at approximately 680 metres from the Proposal footprint (refer to Chapter 8 in Appendix D).

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5.1.2.3 POTENTIAL IMPACTS DURING OPERATION

The potential noise impacts during operation of the Proposal would be associated with traffic along the new road. Therefore, the existing traffic noise within the Proposal footprint was compared to the predicted traffic noise from operation of the Proposal for both the year of opening (2021) and 10-year forecast traffic flows (2031). The noise model for the operational noise assessment is described in Chapter 6 in Appendix D.

The modelling results predicted that there would be no exceedances of the adopted operational noise criteria for all NCAs and both day and night periods (refer to Table 6.3 in Appendix D). Therefore, no operational noise impacts are expected due to the Proposal.

5.1.3 BIODIVERSITY IMPACTS

This section has been informed by a Biodiversity Assessment Report prepared for the Proposal by ecologists from WSP (provided in Appendix B). Penrith LGA is classified as an interim designated area under Part 7 Reg 27 of the Biodiversity Conservation (Savings and Transitional) Regulation 2017 and as such former planning provisions continue to apply to pending or interim planning applications that are submitted before 24 November 2018.

5.1.3.1 EXISTING BIODIVERSITY

VEGETATION TYPES

Table 5.2 describes the three native vegetation plant community types (PCTs) and two non-native vegetation types that were recorded within the Proposal footprint during field surveys. Detailed descriptions of the vegetation types and a figure showing the location of the PCTs within the Proposal footprint are provided in Section 3.2 of Appendix B.

Table 5.2 Overview of native and non-native vegetation types recorded within the Proposal footprint

VEGETATION TYPE	VEGETATION ZONE	THREATENED ECOLOGICAL COMMUNITY (REFER TO SECTION 4.1 AND SECTION 4.4 IN APPENDIX B)	AREA IN PROPOSAL FOOTPRINT (HA)
Native vegetation			
PCT 724 Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	VZ1 – Moderate condition	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Critically Endangered under the EPBC Act) Shale Gravel Transition Forest in the Sydney Basin Bioregion (Endangered under the BC Act)	0.90
	VZ2 – Low condition	Shale Gravel Transition Forest in the Sydney Basin Bioregion (Endangered under the BC Act)	0.49
PCT 835 Forest Red Gum-Rough-barked Apple Grassy Woodland on Alluvial Flats of the Cumberland Plain, Sydney Basin	VZ3 – Moderate condition	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered under the BC Act)	1.91
PCT 849 Grey Box-Forest Red Gum Grassy Woodland on Flats of the Cumberland Plain, Sydney Basin	VZ4 – Moderate condition	Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered under the BC Act)	0.55
		Total native vegetation	**3.85**

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VEGETATION TYPE	VEGETATION ZONE	THREATENED ECOLOGICAL COMMUNITY (REFER TO SECTION 4.1 AND SECTION 4.4 IN APPENDIX B)	AREA IN PROPOSAL FOOTPRINT (HA)
Non-native vegetation			
Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation	VZ5	-	5.86
Miscellaneous ecosystem – urban exotic / native landscape plantings	VZ6	-	0.12
		Total non-native vegetation	**5.98**

THREATENED FLORA SPECIES

Background research identified 24 threatened flora species that have been previously recorded or have the potential to occur within the locality of the study area. Eight of these threatened flora species were identified to have a moderate to high likelihood of occurrence within the Proposal footprint, and were subject to targeted flora surveys.

Table 5.3 presents the results of the targeted flora surveys for threatened flora. Further descriptions of the threatened flora species are provided in Section 4.2 of Appendix B.

Table 5.3 Threatened flora species within the study area

SPECIES NAME	COMMON NAME	BC ACT	EPBC ACT	LIKELIHOOD OF OCCURRENCE	AFFECTED SPECIES
Acacia pubescens	Downy Wattle	Vulnerable	Vulnerable	Moderate	No – No individuals were recorded.
Dillwynia tenuifolia	-	Vulnerable	-	**Recorded**	**Yes –** This species was recorded in PCT 724. During field surveys, nine individuals were recorded.
Grevillea juniperina subsp. *juniperina*	Juniper-leaved Grevillea	Vulnerable	-	**Recorded**	**Yes –** This species was recorded in all plant community types and vegetation types within the study area. During field surveys, 1,273 individuals were recorded.
Hibbertia fumana	-	Critically endangered	-	Moderate	No – *Hibbertia* sp. with similar leaf morphology and form to *Hibbertia fumana* was recorded during field surveys and sampled. Samples were forwarded to the National Herbarium of New South Wales for positive identification. All samples were identified as *Hibbertia pedunculata* (RBG Enquiry No. BIS 20780). No *Hibbertia fumana* individuals were recorded.
Micromyrtus minutiflora	-	Endangered	Vulnerable	Moderate	No – No individuals were recorded.
Persoonia nutans	Nodding Geebung	Endangered	Endangered	Moderate	No – No individuals were recorded.

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SPECIES NAME	COMMON NAME	BC ACT	EPBC ACT	LIKELIHOOD OF OCCURRENCE	AFFECTED SPECIES
Pimelea spicata	Spiked Rice-flower	Endangered	Endangered	Moderate	No – No individuals were recorded.
Pultenaea parviflora	-	Endangered	Vulnerable	**Recorded**	**Yes** – This species was recorded in PCT 835 and PCT 724. During field surveys, 45 individuals were recorded.

THREATENED FAUNA

Background investigations identified 18 threatened fauna species listed under the BC Act that have been recorded or are considered to have a moderate to high likelihood to occur within the study area (summarised in Table 5.4).

A total of 36 fauna species were during field investigations for the Proposal including one amphibian species, 30 bird species, three mammal species and one reptile species. However, only one threatened fauna species was recorded, the Cumberland Plain Land Snail (*Meridolum corneovirens*).

Table 5.4 Threatened fauna recorded or with a moderate to high likelihood of occurrence in the study area

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	LIKELIHOOD OF OCCURRENCE
Birds				
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	**Moderate** – potential foraging habitat identified within study area.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	**Moderate** – potential foraging habitat within study area.
Chthonicola sagittata (syn. Pyrrholaemus sagittatus)	Speckled Warbler	V	-	**Moderate** – potential foraging habitat within study area.
Daphoenositta chrysoptera	Varied Sittella	V	-	**Moderate** – potential foraging habitat within study area.
Glossopsitta pusilla	Little Lorikeet	V	-	**Moderate** – potential foraging habitat within study area.
Hieraaetus morphnoides	Little Eagle	V	-	**Moderate** – potential foraging habitat available in study area
Lophoictinia isura	Square-tailed Kite	V	-	**Moderate** – potential foraging habitat within study area.
Ninox strenua	Powerful Owl	V	-	**Moderate** – potential foraging habitat available in study area. Recent records within locality.
Invertebrates				
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	**Recorded.** This species was recorded in PCT 849.

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SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	LIKELIHOOD OF OCCURRENCE
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	**Moderate** – foraging habitat identified within study area.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	**Moderate** – foraging and potential roosting habitat identified within study area.
Miniopterus australis	Little Bent-wing Bat	V	-	**Moderate** – foraging habitat identified within study area.
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	-	**Moderate** – foraging habitat identified within study area.
Mormopterus (Micronomus) norfolkensis	Eastern Freetail Bat	V	-	**High** – foraging and potential roosting habitat identified within study area
Myotis macropus	Southern Myotis	V	-	**Moderate** – previously recorded adjacent to study area in association with South Creek tributaries and adjacent waterbodies.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	**High** – foraging habitat identified within study area.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	**Moderate** – foraging and potential roosting habitat identified within study area.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	**Moderate** – foraging and potential roosting habitat identified within study area.

(1) V = Vulnerable, E = Endangered species listed under the BC Act

(2) V = Vulnerable, E = Endangered listed under the EPBC Act

FAUNA HABITAT

Two fauna habitats were identified within the study area (refer to Section 3.5 in Appendix B):

- open sclerophyll woodland, which is associated with PCT 724, PCT 835 and PCT 849, partially disturbed and in a poor to medium condition
- disturbed land with limited native vegetation, which is associated with the vegetation type classed as miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation.

The open sclerophyll woodland was noted to have some fallen timber and dumped rubbish/building materials which would provide some microhabitat for ground dwelling reptiles, invertebrates and small mammals that are well adapted to fragmented urban landscapes. There was also a low to moderate cover of semi-mature to mature trees, which would provide suitable foraging habitat for nectar feeding (i.e. Honeyeaters and Lorikeets) and seed-eating fauna. Small hollows and stags along the riparian area would be suitable for roosting opportunities for microchiropteran bats.

The disturbed land habitat type was observed to have ground cover dominated with exotic grasses and herbaceous weeks with very limited fallen timber or rocky habitat. These areas are likely to provide foraging habitat for common species typical of disturbed environments or parklands (i.e. Australian Magpie, Magpie-lark and Masked Lapwing).

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OTHER BIODIVERSITY CONSIDERATIONS:

- Based on field investigations and habitat assessments, one migratory species listed under the EPBC Act has a moderate likelihood to occur within the study area - Rhipidura rufifrons (Rufous Fantail).
- Out of the 73 exotic flora species recorded within the study area, 29 species are listed as High Threat weeds under the BC Act, six species are listed as priority weeds under the NSW *Biosecurity Act 2015* for the Greater Sydney region and six are listed as Weeds of National Significance.

5.1.3.2 POTENTIAL IMPACTS DURING CONSTRUCTION

The potential impacts to biodiversity from construction of the Proposal include (refer to Section 5.1 in Appendix B):

- removal of approximately 2.73 ha of native vegetation and 5.98 ha of non-native vegetation which form known and potential habitat for 18 threatened fauna species and three threatened flora species
- removal of threatened flora, including 652 *Grevillea juniperina subsp. juniperina* individuals (listed as Vulnerable under the BC Act) and 30 *Pultenaea parviflora* individuals (listed as Endangered under the BC Act and Vulnerable under the EPBC Act)
- impacts on threatened fauna species listed under the BC Act and EPBC Act, and their habitat including woodland birds, predatory birds, invertebrates and bats
- aquatic impacts associated with a reduction in water quality from erosion and sediment, changes to the geomorphology of watercourses and loss of freshwater and riparian habitat
- changes to hydrology (including erosion and sedimentation)
- increases in fauna injury and/or mortality from use of machinery, vehicle movements and removal of vegetation and habitat
- wildlife connectivity and habitat fragmentation
- potential environmental impact of noise and vibration on wildlife from construction activities
- weed and pest invasion and/or invasion and spread of pathogens and disease from equipment and vehicle movements.

Assessments of impact of impact significance were conducted for all threatened entities considered likely to be affected by the construction of the Proposal. Through these assessments, it was concluded that the proposal is unlikely to have a significant impact on any threatened species, populations or ecological communities. Mitigation measures would be implemented to avoid any additional impacts (including through establishment of vegetation exclusion zones) and minimise the potential biodiversity impacts associated with construction (refer to Chapter 6).

5.1.3.3 POTENTIAL IMPACTS DURING OPERATION

The potential impacts to biodiversity from operation of the Proposal include (refer to Section 5.1 in Appendix B):

- aquatic impacts and changes to hydrology associated with an increase in impervious surfaces
- increases in fauna injury and/or mortality from public use of the road
- wildlife connectivity and habitat fragmentation including genetic isolation and edge effects
- potential environmental impact of noise and vibration on wildlife from vehicle movements
- weed and pest invasion and/or invasion and spread of pathogens and disease from vehicle movements.

Assessments of impact significance were conducted for all threatened entities considered likely to be affected by the operation of the Proposal. Through these assessments, it was concluded that the proposal is unlikely to have a significant impact on any threatened species, populations or ecological communities.

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5.2 OTHER CONSIDERATIONS

5.2.1 TRAFFIC, TRANSPORT AND ACCESS IMPACTS

This section has been informed by a Traffic Impact Study prepared for the Proposal by ecologists from WSP (provided in Appendix C).

5.2.1.1 EXISTING TRANSPORT INFRASTRUCTURE AND CONDITIONS

ROAD NETWORK

Table 5.5 summarises the key roads in the existing road network within and surrounding the Proposal footprint.

Table 5.5 Existing local road network surrounding the Proposal footprint

KEY ROAD	TYPE	CONNECTIVITY	OTHER
Links Road and Dunheved Circuit	Local road	— Provides local access to the industrial land uses north of Christie Street — Links Road connects Ropes Crossing Boulevard to the east and terminates at the Dunheved Golf Club to the west	— 60 km/h posted speed limit — The section of Links Road next to Dunheved Golf Club currently contains a narrow carriageway and no kerb and gutter
Lee Holm Road	Local road	— Provides access to the industrial land uses such as Dunheved Business Park, located south of Christie Street — Runs north-south road and connects Christie Street to the north	— N/A
Dunheved Road and Christie Street corridor	Sub-arterial regional road	— Runs east-west parallel to the Great Western Highway	— 60 km/h posted speed limit — One-lane in each direction — Provides right-turning lanes at several priority-controlled T-junctions (including the intersection with Lee Holm Road)
Forrester Road	Regional road	— Runs north–south connecting Palmyra Avenue and the Great Western Highway	— 60-70 km/h posted speed limit — Generally two-lanes in each direction — Several signalised and priority-controlled intersections accessing local roads
Werrington Road	Sub-arterial regional road	— Runs north-south connecting the Great Western Highway and Dunheved Road and Christie Street	— One-lane in each direction

The existing intersection at Christie Street and Lee Holm Road contains one travel lane in each direction. The current traffic volumes using Christie Street, Lee Holm Road are presented in Tables 3.1 and 3.2 in Appendix C. Although Christie Street is carrying volumes over its theoretical capacity, site observations and traffic survey data indicate that Christie Street generally operates satisfactorily. However, the existing intersection with Christie Street and Lee Holm Road was modelled to have an unsatisfactory level of service (LoS) “F” due to long delays associated with the south

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approach right-turn movement. Heavy vehicles make up approximately 8 per cent of the intersection vehicle demand flow during the AM peak hour and 3.2 per cent during the PM peak hour.

Projected future demand volumes from the AIMSUN model from the St Marys Modelling Study were also used to determine the likely conditions of the existing Christie Street and Lee Holm Road intersection in the future. The modelling showed that the existing priority-controlled intersection layout at Christie Street and Lee Holm Road would continue to operate poorly, with unsatisfactory LoS "F" predicted under all future year scenarios (2021, 2026 and 2031).

The current traffic volumes on Links Road are low, particularly on the section adjacent to Dunheved Golf Club, given it is currently a no-through road (refer to Section 3.2 in Appendix C).

PUBLIC TRANSPORT

Two bus routes, Route 780 and Route 782, travel within the Proposal footprint at the intersection of Christie Street and Lee Holm Road. There is an existing bus stop located on the northern side of Christie Street, directly opposite Lee Holm Road. There is also a bus stop on the southern side for the return journey, west of Lee Holm Road.

ACTIVE TRANSPORT

No designated cycling facilities are provided on Christie Street, Lee Holm Road or Links Road within the vicinity of the Proposal.

Pedestrian footpaths currently exist on the southern side of Christie Street for its entire length. There are no footpaths on Lee Holm Road or Links Road.

5.2.1.2 POTENTIAL IMPACTS DURING CONSTRUCTION

Potential traffic, transport and access impacts associated with the construction of the Proposal include (refer to Chapter 5 in Appendix C):

- a minor increase in traffic volumes along the haulage routes due to the additional light vehicle and heavy vehicle movements generated by construction (refer to Section 3.2.5). However, given the low number of vehicles expected, this is unlikely to negatively impact the surrounding road network
- a minor traffic impact due to partial road/lane closures on Links Road as well as Christie Street and Lee Holm Road during construction of the intersection.

However, these impacts would be temporary and minimised through mitigation measures (refer to Chapter 6).

5.2.1.3 POTENTIAL IMPACTS DURING OPERATION

SIDRA modelling analysis was undertaken to determine the potential impact of the operation of the Proposal on the intersection performance at Christie Street and Lee Holm Road. The SIDRA modelling results showed that with operation of the Proposal, the intersection is expected to operate satisfactorily at the LoS "C" or better under all future year scenarios (refer to Section 4.1 in Appendix C). Therefore, as the existing intersection layout is expected to have a unsatisfactory Los "F" under all future year scenarios, the operation of the Proposal would substantially improve the performance of this intersection from a LoS "F" to a LoS "C".

In the St Marys Modelling Study, the Links Road extension was assessed to redirect approximately 300 vehicles per hour in 2021 and 600 vehicles per hour in 2031 from the Forrester Road/Ropes Crossing Boulevard and Forrester Road/Christie Street intersections to the Links Road Extension/Christie Street/Lee Holm Road intersection. The modelling suggests that due to the additional lanes on Christie Street and intersection upgrade as part of the Proposal, the re-directed traffic is unlikely to result in congestion. Therefore, the operation of the Proposal would not have a noticeable negative impact on the local road network performance in future years (refer to Section 4.2 in Appendix C).

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Other potential traffic and transport impacts due to operation of the Proposal include:

- a minor impact due to the realigned access to Dunheved Golf Club, however the new access design would allow full movements and would not negatively impact access
- improved access to the St Marys Development site, due to the additional road connection that the Proposal would provide, which may also substantially shorten some trip distances for future St Marys Development residents and Dunheved Golf Club visitors
- a minor impact on public transport, due to the relocation of the bus stops near the intersection of Christie Street and Lee Holm Road, which may slightly increase or reduce walking distances for bus passengers. However, the bus stops would be improved by new hardstand areas, which would reduce potential safety hazards associated with slippery road surfaces in wet weather
- improved pedestrian and cyclist safety at the Christie Street, Lee Holm Road and Links Road intersection, due to the full pedestrian crossings and shared path along Links Road.

5.2.2 HERITAGE IMPACTS

This section has been informed by an Aboriginal Archaeological Survey Report prepared for the Proposal by Artefact Heritage (provided in Appendix E). This survey report included the results of an archaeological survey of the site undertaken on 25 September 2018, with a representative on behalf of the Deerubbin Local Aboriginal Land Council (Deerubbin LALC) in attendance. It also includes background research on the non-Aboriginal heritage within the area.

5.2.2.1 EXISTING HERITAGE CONTEXT

ABORIGINAL HERITAGE

An extensive search of the OEH Aboriginal Heritage Information Management System (AHIMS) database was undertaken on the 17 September 2018 (AHIMS search ID 370996) for the land within and surrounding the Proposal footprint. An area of approximately four kilometres by one kilometre was included in the search. A total of 116 Aboriginal sites were identified in the extensive AHIMS search area (refer to Table 5.6).

Table 5.6 Frequency of site features from AHIMS data

SITE FEATURE	FREQUENCY	PERCENTAGE (%)
Artefact	93	80.2
Artefact, Potential Archaeological Deposit (PAD)	18	15.5
Artefact, Stone Quarry	3	2.6
PAD	2	1.7
Total	**33**	**100**

None of the Aboriginal sites or PADs identified within the AHIMS search area are recorded within the Proposal footprint. Five Aboriginal sites are recorded within 200 metres of the study area, which predominantly comprise stone artefact scatters (refer to Figure 4.2 in Appendix E). In addition, no gazetted Aboriginal places, Native Title claims or intangible places were identified within the Proposal footprint.

Land use in the surrounding local area has historically consisted of stock grazing, and construction of road and rail infrastructure. In particular, areas of disturbance were most extensive within Links and Lee Holm Roads, Christie Street road corridor and the old railway corridor, and may have potentially disturbed Aboriginal sites. The field survey identified that the roadway was cut into the landscape, and as a result possible artefact bearing deposits would most likely have been removed. The land surrounding the road and rail corridor would also likely have been subject to extensive surface and sub-surface disturbance including from construction of footpaths, underground services, driveways and the electricity transmission infrastructure.

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Based on the field survey, background research and previous archaeological assessments, it was concluded that:

- no Aboriginal sites or areas of PAD have been identified within the Proposal footprint
- Aboriginal sites in the surrounding area are likely to comprise surface and sub-surface scatters of predominantly silcrete stone artefacts
- the Proposal footprint is approximately 120 metres from the nearest permanent water body (South Creek). Predictive modelling indicates that stone artefacts (if any) would more commonly be found within 50-100 metres of South Creek
- based on the expected level of disturbance, the Proposal footprint is considered to be of low archaeological significance and it is considered unlikely that intact archaeological deposits will be present. This assessment supports the earlier assessment made by JMCHM (2004) that the northern section of the Proposal footprint within the Dunheved Precinct requires no further archaeological assessment
- unexpected Aboriginal archaeological material may be present within disturbed contexts and would be dealt with through standard unexpected finds protocols (refer to Chapter 6). Any Aboriginal objects retrieved from these layers would likely be assessed as holding low scientific significance due to a lack of archaeological context and integrity.

NON-ABORIGINAL HERITAGE

The proposal sits within the suburb of St Marys, originally a township along the banks of South Creek. The north section of the Proposal footprint is located within the Australian Defence Industries site, while the majority of the Proposal footprint is located within a zone that has historically been characterised as rural or semi-rural in nature. The now abandoned Ropes Creek railway line was built in 1942 and closed in 1986 and parts of the railway corridor are still present on the site. The historical background of the Proposal footprint is described in further detail in Section 3.2 of Appendix E.

Background research identified the following non-Aboriginal heritage listed items within and surrounding the Proposal footprint:

- One site listed on the SREP 30 within the northern portion of the Proposal footprint, Site 1 – Dunheved Homestead (shown on Figure 5.2). The Dunheved Homestead site is "likely to contain extensive intact archaeological structures, features, deposits and relics that span 140 years of European settlement beginning circa 1807. It is of State Heritage significance" (JBA, 2007).
- One site on the Register of the National Estate (RNE), the King Family Farm Sites and Trees, within the northern portion of the Proposal footprint (refer to Section 2.2.2 in Appendix E). The RNE is a non-statutory archive within the Australian Heritage Database. The King Family Farm Sites date from ca.1807 and comprises the Dunheved and the Elizabeth King Farm archaeological sites and nineteenth century trees.
- One site listed on Penrith LEP, the Dunheved Fire Station, that is adjacent to the Proposal footprint, north of the Christie Street and Lee Holm Road intersection.
- No Commonwealth heritage listed, World heritage listed or National heritage listed sites within the Proposal footprint.

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5.2.2.2 POTENTIAL IMPACTS DURING CONSTRUCTION

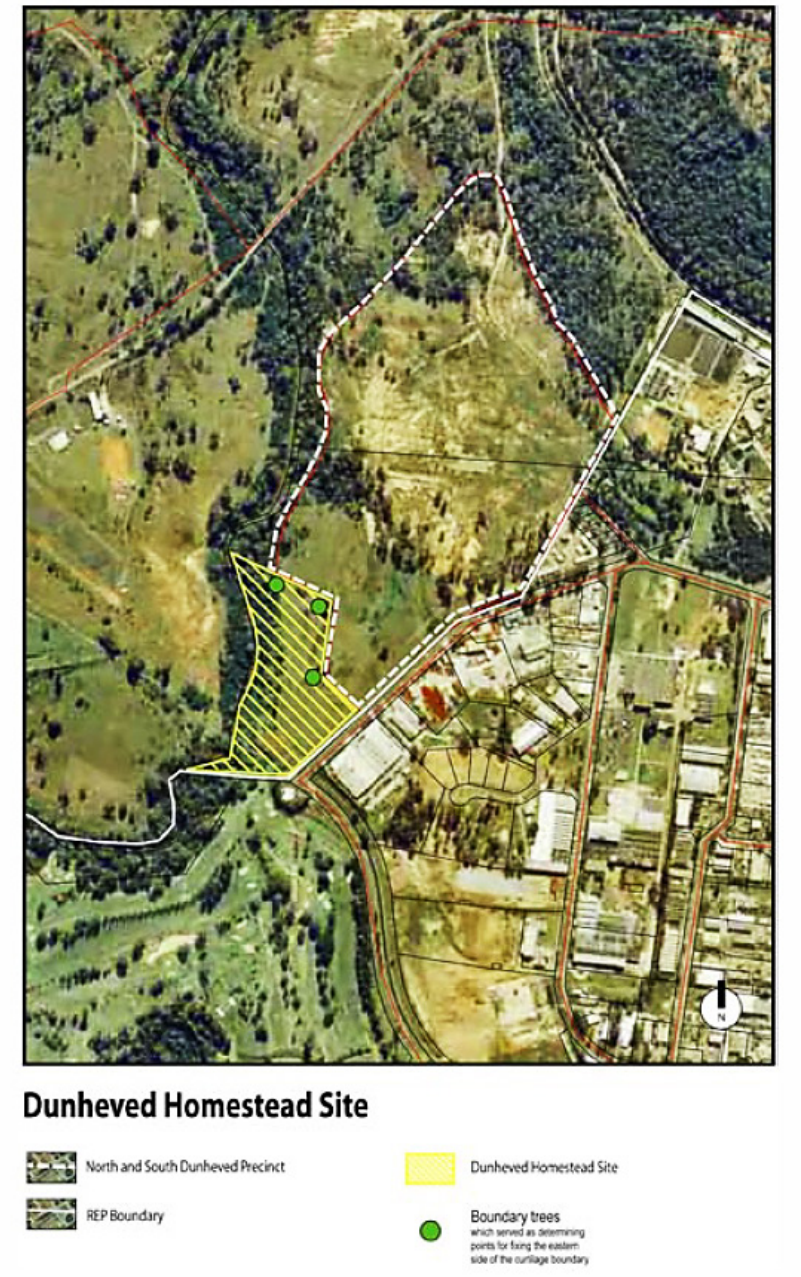


Figure 5.2 Location of the Dunheved Homestead Site (JBA, 2007)

Given no Aboriginal sites or areas of PAD have been identified within the Proposal footprint, and the Proposal footprint was assessed as having low archaeological significance, there are not expected to be any impacts on Aboriginal heritage from the construction of the Proposal. However, mitigation measures would be implemented to manage any unexpected Aboriginal archaeological material (refer to Chapter 6).

The Proposal footprint includes a minor encroachment of less than five metres into the curtilage of the Dunheved Homestead site defined under the SREP 30. The development associated with the Proposal within the curtilage provides a shared path, grassed verge and batter and street lighting. As per the Precinct Plan and Development Control Strategy for the North and South Dunheved Precincts, "the curtilage of the Dunheved site has been defined under SREP 30 to incorporate the remains of the main homestead group including the main heritage trees and plantings that were associated with the house. It is considered that 90% to 95% of the archaeological remains, including all of the known significant remains are located within the established curtilage of the Dunheved Homestead site (JBA, 2007)". The Proposal is not expected to impact on the visual setting of the heritage item as it would be an upgrade of the existing road adjacent to the curtilage, and so would not be a new visual element within the landscape. Due to the limited encroachment into the curtilage and the unexpected heritage finds procedure that would be implemented during construction, it is unlikely that the Proposal would involve physical damage to any archaeological remains. However, further consultation with heritage specialists and Penrith City Council would be undertaken prior to construction commencing to minimise potential impacts on non-Aboriginal heritage.

5.2.2.3 POTENTIAL IMPACTS DURING OPERATION

The operation of the Proposal is not expected to have any impact on non-Aboriginal or Aboriginal heritage.

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5.2.3 SURFACE WATER AND GROUNDWATER IMPACTS

5.2.3.1 EXISTING SURFACE WATER CONTEXT

The nearest named surface waterbody to the Proposal footprint is South Creek, which is located about 120 metres away at its closest point. However, an unnamed watercourse of South Creek goes through the Proposal footprint near the entrance to Dunheved Golf Club. It is expected that runoff on the site currently drains towards Dunheved Golf Club and the low laying drainage areas surrounding the site (JBS&G, 2018).

The Proposal footprint is affected by mainstream flooding from South Creek and has been partially identified as flood planning land under Penrith LEP.

A review of registered groundwater monitoring wells in the vicinity of the Proposal footprint indicated that groundwater is likely to be encountered between 4 to 8 mBGL (JBS&G, 2018).

5.2.3.2 POTENTIAL IMPACTS DURING CONSTRUCTION

As discussed in Section 5.1.1.2, clearing of vegetation and earthworks during construction would expose soil and could lead to sedimentation. Transport of soils to stockpiles and construction site compounds could potentially result in runoff impacts, leading to increased pollution or turbidity in nearby waterways. However, the implementation of standard safeguards would mean that related impacts would be avoided and/or appropriately mitigated.

Other potential surface water impacts include changed runoff and drainage patterns due to ground compaction and cut and fill work, as well as a risk of contamination due to chemical spills. Sediment basins have not been proposed due to the constrained boundary and proximity of the proposed works to existing buildings. However, the implementation of standard safeguards would mean that related impacts would be avoided and/or appropriately mitigated.

Impacts on groundwater are unlikely, as no excavations deeper than 4 mBGL are proposed for the construction of the Proposal. However, in the event that groundwater is encountered during construction, standard dewatering and water disposal procedures would be implemented to minimise impacts.

5.2.3.3 POTENTIAL IMPACTS DURING OPERATION

The hard surface of the roadway may lead to increased runoff during operation of the Proposal. This would be channelled to specific drainage measures and outfall points (refer to Section 3.1.3). The drainage system and road design for the Proposal has been designed to minimise flood impacts.

Proprietary water quality improvement devices have been provided at the longitudinal drainage outlets to ensure that South Creek and its tributaries are protected against spills occurring on the new pavement. Therefore, surface water impacts associated with the operation of the Proposal are expected to be avoided or otherwise appropriately mitigated through design.

The road has been designed to be flood free in a 5% AEP (1 in 20 year) ARI flood event from South Creek as per Penrith City Council's requirements.

5.2.4 VISUAL IMPACT

5.2.4.1 EXISTING VISUAL CONTEXT

The Proposed footprint is partially within land zoned as having scenic and landscape values under the Penrith LEP. However, the Proposal footprint is predominantly located within an existing road corridor, an industrial zone or within a disused rail corridor (refer to Section 2.2.2). These surrounding land uses have little aesthetic value and would have low sensitivity to change.

The visual receivers surrounding the Proposal footprint are limited to users of Dunheved Golf Course, motorists on Links Road and staff of the surrounding industrial properties. These visual receivers would be transient through the Proposal footprint and would not be considered as sensitive visual receivers.

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5.2.4.2 POTENTIAL IMPACTS DURING CONSTRUCTION

The construction of the Proposal would involve the removal of vegetation, however views of the road from industrial properties near the Christie Street and Lee Holm Road intersection would largely be screened by the vegetation to be retained.

5.2.4.3 POTENTIAL IMPACTS DURING OPERATION

The Proposal would have a negligible visual impact during operation as it would not introduce a new visual element within the landscape, as the road would be similar to the existing roads within the local visual context, and there are no sensitive visual receivers. In addition, the Proposal would not include any buildings or significant changes in the existing ground levels, therefore there would be negligible overshadowing impacts.

5.2.5 PROPERTY AND LAND USE

5.2.5.1 EXISTING PROPERTY AND LAND USES

The majority of the Proposal extends along the existing Links Road corridor. Links Road is a local road that currently serves the existing Dunheved industrial area. The land uses surrounding the Proposal footprint predominantly comprises industrial development, Dunheved Golf Club and vacant bushland (refer to Section 2.2). The land zoning across the Proposal footprint includes (refer to Figure 2.3):

- IN1 General Industrial (Penrith LEP)
- Regional Park (SREP 30)
- Employment (SREP 30).

The Proposal footprint goes through land that is owned by Lendlease, Penrith City Council, Roads and Maritime, Dunheved Golf Course, Sydney Water and private business owners (refer to Table 2.1).

5.2.5.2 POTENTIAL IMPACTS DURING CONSTRUCTION

Temporary loss of or changes to access may be experienced by landholders during construction. Affected land owners may need to access their properties via alternate routes, however this is not expected to cause delays or increase travel times.

Construction activities are also expected to impact on existing utilities and services including underground services such as water, electricity and telecommunications. Lendlease would consult with relevant service providers during detailed design to identify possible interactions and develop procedures to be implemented to minimise the potential for service interruptions which have the potential to impact on existing land use.

5.2.5.3 POTENTIAL IMPACTS DURING OPERATION

The Proposal would require the acquisition of land from the NSW Government, business and private owners. Permanent land acquisitions for the project are outlined in Table 2.1. The land to be acquired totals approximately 18,150m^2. No houses would be subject to acquisition. Most of the acquisition required for the Proposal consists of very small parcels of land along property boundaries from neighbouring properties. As such, there would be minimal fragmentation of properties located along the Proposal footprint and the land use for the remaining land would be unaffected. All acquisitions of privately owned land would be carried out in consultation with landowners and in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the supporting NSW Government Land Acquisition Reform 2016.

5.2.6 CUMULATIVE IMPACTS

There may be cumulative impacts, particularly for traffic and noise and vibration, if two or more projects are constructed at the same time near the Proposal footprint. Known planned projects in the area include a proposed service station adjacent to the intersection with Christie Street and Lee Holm Road (DA16/1239) and the Dunheved Link Road project (DA18/0221). Lendlease would consult with other developers and projects in the area to obtain information about project timeframes and schedule construction to avoid cumulative impacts where possible.

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6 SITE MANAGEMENT

The principal construction contractor would detail the site management measures to be implemented in a Construction Environmental Management Plan (CEMP). This would include protocols and procedures as relevant from the contractors Environmental Management Systems, such as:

- environmental policy
- permits and approvals needed
- roles and responsibilities
- training and awareness including inductions
- subcontractor management
- communications protocols
- incidents and emergencies including spill management procedures,
- inspections, monitoring and auditing
- measures to manage:
  - establishment of construction compounds and laydown locations
  - traffic and access
  - erosion and sediment including dust control methods
  - demolition and waste generation
  - unexpected contamination
  - landscaping requirements
  - stormwater management
  - noise generation
  - potential heritage impacts
  - impacts to native vegetation.

Table 6.1 provides a high-level overview of the types of site management measures to be considered and implemented during construction of the Proposal and outlined in the CEMP.

Table 6.1 Indicative site management measures

SITE MANAGEMENT MEASURE	DESCRIPTION
Establishment of construction compound and laydown areas	The locations where the principal contractor may choose to establish construction compounds and laydown areas are described in Section 3.2.4. These would be located within the Proposal footprint.
Traffic and access management measures	The construction contractor would need to put in place traffic management measures to minimise any traffic and access impacts associated with the works. This would be particularly important during construction of the intersection with Christie Street and Lee Holm Road and construction of the new access to Dunheved Golf Club. Additional measures to consider include: — outlining the approved site access points and parking areas during construction — preventing full closure of Links Road, Christie Street and Lee Holm Road where possible through temporary diversions, lane closures or alternate routes — developing detailed traffic control plans to retain property access and ensure safety. The construction contractor would fence off the site entrance and construction compounds, including signage to warn off the public from accessing the site.

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SITE MANAGEMENT MEASURE	DESCRIPTION
Erosion and dust control	To avoid erosion and dust on site the following measures would be implemented: — preparation of a detailed Erosion and Sediment Control Plan (ESCP) which would be approved prior to vegetation clearing or soil disturbance — use of a water cart which would be brought on site as needed to wet the ground surface and stockpiled materials — sealing of the vehicle roads and topsoiling/grassing other areas disturbed by construction — covering stockpiled materials.
Demolition and waste generation	A waste management plan would be developed for the project which would ensure that any materials reused onsite, or imported to site from another project, would be subject to testing and waste classification exemption provisions in accordance with the *Waste Classification Guidelines* (DECCW, 2009). In accordance with the plan and where possible, the excavated materials would be considered for re-use and recycling. For example: — concrete or excavated soil material: would be re-used for filling or levelling — green waste: would be used for mulching and composting. Should the material be classified as a controlled or restricted waste, or found to contain contaminants of concern at elevated concentrations, it would not be classified for exemption and reuse. It would be stored in a contained separate location onsite before being transported offsite to a licenced facility. It is expected that the in-situ soil material would be classified as General Solid Waste for offsite disposal or reused within the road corridor in accordance with the Reclaimed Asphalt Pavement Order 2014 (refer to Appendix F). The stockpiles of dumped rubbish (including the stockpiles containing fragments of ACM) would be removed from the Proposal footprint during construction as 'special (Asbestos) waste' by a licensed waste contractor. Reusable topsoil and subsoil would be stored in designated and suitable locations. This would ensure the stockpiled material was located away from sensitive areas and flood-prone land, where feasible and reasonable. It would also provide the ability to install controls to manage any leaching, erosion, sediment dispersion and dust dispersion risks and impacts.
Unexpected contamination	If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area would stop until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the EPA. The CEMP would detail the type of hazardous goods and chemicals that may be stored and/or used on site. It would also include handling procedures, storage locations and any management measures and controls put in place to prevent against spillage. A site-specific emergency spill plan would be developed to address measures to be implemented in the event of a spill, including initial response and containment and notification of relevant authorities.
Landscaping requirements	Landscape construction would be carried out by a qualified landscape contractor to ensure that adequate standards of workmanship are achieved. Landscape contractors who are members of the Landscape Contractors Association of NSW would be engaged where possible.

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SITE MANAGEMENT MEASURE	DESCRIPTION
Stormwater management	A detailed Stormwater Management Plan (SWMP) would be developed prior to commencement of construction activities to ensure management of water quality and quantities during construction works. An indicative stormwater concept plan for the Proposal would be provided with the DA and refined during detailed design.
Noise generation	A construction noise and vibration management plan (CNVMP) would be developed for the Proposal prior to construction and included in the CEMP. The CNVMP would outline the: — identified nearby residences and other sensitive land uses — approved hours of work and what work would be undertaken — significant noise and vibration generating activities — details of noise mitigation and management measures to be applied — information for worker training to minimise noise impacts — community consultation protocol(s) and/or complaints handling protocol(s) Standard mitigation measures (in accordance with Section 6 of the Interim Construction Noise Guideline) which would be considered as part of the CNVMP include: — carry out work inside standard hours (7am-6pm Mon-Fri, 8am-1pm Sat) where practicable — at night, work involving high noise generating equipment (e.g. concrete saw, dozer, mulcher, profiler, rock breaker) would be concluded prior to 11pm where practicable — design the compound layout so that the use of reversing alarms is minimized — avoid dropping materials from a height — turn off plant items and vehicles when not in use — notify residents in NCAs that will be affected by noise (NCAs 1, 2, 4, and 5) of the project scope and duration of noisy works, particularly for out-of-hours work.
Heritage	The CEMP would include measures to avoid and/or minimise heritage impacts, including potential impacts on Dunheved Homestead, the King Family Farm Sites and Trees and Dunheved Fire Station. This would include ongoing consultation with Penrith City Council and OEH during the detailed design process. During detailed design, further consideration of mitigations would be undertaken as well as further assessment by a heritage specialist to resolve the likelihood of non-Aboriginal archaeological relics associated with the Dunheved Homestead within the Proposal footprint prior to construction. If any unexpected archaeological relics are found within the Proposal footprint during construction, works would stop and an archaeologist and OEH would be informed. No Aboriginal objects have been identified within the Proposal footprint. Works can proceed with caution, without further archaeological investigation. If unforeseen Aboriginal objects are uncovered during construction, work would cease, and an archaeologist, the Office of Environment and Heritage and the Deerubbin LALC would be informed. If suspected human remains are located during any stage of the proposed works, work must stop immediately, and the NSW Police must be notified. The Office of Environment and Heritage must be notified if the remains are found to be Aboriginal ancestral remains.

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SITE MANAGEMENT MEASURE	DESCRIPTION
Native vegetation	A flora and fauna management plan would be developed for the project and would include the following general measures are recommended to ensure ecological impacts are minimised (refer to Appendix B): — implement pre-clearing protocols, including engagement of an experienced fauna ecologist to check for the presence of flora and fauna species and habitat before clearing — conduct an environmental induction to inform construction personnel of environmental management procedures and vegetation exclusion zones including issues related to flora and fauna management, weed control, erosion and sediment control — establishment of vegetation exclusion zones (as outlined in Figure 3.1) to protect vegetation and fauna habitat outside of the assessed and approved clearing limits. Vegetation to be retained are to be clearly defined on ground and 'no go zones' clearly signposted and fenced to prevent unauthorised clearing and vehicular and/foot traffic — the limits of clearing would be clearly demarcated on-site (where appropriate) prior to construction to avoid unnecessary vegetation and habitat removal. This could include the installation of fencing around the proposal site footprint — implement clearing and construction protocols, including avoiding excessive disturbance — when accessing construction sites, contractors would only use designated access tracks — salvage dead timber from proposal site into adjacent habitat to provide ground habitat — procedures to manage and control weed species and prevent spread of pests and pathogens. These measures would be included in a construction biodiversity management sub-plan of the construction environment management plan (CEMP).

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7 CONCLUSION

7.1 SITE SUITABILITY

The site location is based on the existing location of Links Road, and the need for an additional road connection between Links Road and Christie Street. The Proposal design has taken the site constraints into consideration including:

- Bushfire prone land: the Penrith LEP indicates the majority of the Proposal footprint consists of bushfire prone land classed as vegetation Category 2 and vegetation buffer land. However, it is a road development so is unlikely to be affected by bushfire or increase likelihood of bushfires in the area.
- Flooding: some of the Proposal footprint has been identified as flood planning land under Penrith LEP, however the road design incorporates stormwater drainage measures to minimise flood risks.
- Within 40 metres of mapped watercourse: the Proposal includes stormwater drainage measures and erosion and sediment control measures to minimise impacts on surface water.
- Biodiversity: vegetation exclusion zones have been established and mitigation measures would be implemented to ensure there would be no significant biodiversity impact associated with construction and operation of the Proposal.
- Various easements across multiple properties: Lendlease would continue to carry out consultation with landowners during detailed design and construction to manage the potential property impact.
- Heritage: the Proposal has a minor encroachment into the Dunheved Homestead curtilage, which would be resolved prior to construction through further consultation and archaeological assessment.

Therefore, the potential environmental impacts associated with the construction and operation of the Proposal would be mitigated through standard and site specific mitigation measures to reduce potential environmental impact (refer to Sections 5 and 6). As a result, the site is considered suitable for the construction and operation of the Proposal.

7.2 PUBLIC INTEREST

Lendlease has a legal obligation to deliver the Proposal under the revised Deed of Agreement with Penrith City Council. The Proposal would provide additional access to the St Marys Development Site from the south via Christie Street. This additional access connection is in the public interest as it would provide an alternate emergency access route and potentially shorten travel times for some road users.

In addition, the Proposal has considered the goals of ecologically sustainable development in accordance with Clause 6(2) of the *Protection of the Environment Administration Act 1991 No 60* as follows:

- Precautionary principle: the specialist assessments have been prepared to assess the potential environmental impact of the Proposal and provide recommendations to mitigate against any threats of serious or irreversible environmental damage.
- Inter-generational equity: the Proposal would not degrade the environment during operation for future generations.
- Conservation of biological diversity and ecological integrity: this was a fundamental consideration in the development of the vegetation exclusion zones and selection of the construction compound locations.
- Improved valuation, pricing and incentive mechanisms: environmental factors would be included in the valuation of assets and services during construction and operation.

7.3 EVALUATION

Therefore, the Proposal is recommended to be approved for development by Penrith City Council as the Proposal is:

- unlikely to cause a significant impact on the environment provided that appropriate mitigation measures are implemented during the construction of the Proposal (Refer to Section 6)
- in the public interest and in accordance with Lendlease's legal obligation to deliver the Proposal under the revised Deed of Agreement.

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8 REFERENCES

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APPENDIX A

PENRITH DCP COMPLIANCE TABLE

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A1 PENRITH DCP COMPLIANCE TABLE

SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
1.2 Principles	The development would: — Principle 1: Provide a long-term vision for cities, based on sustainability; intergenerational, social, economic and political equity; and their individuality. — Principle 2: Achieve long term economic and social security. — Principle 3: Recognise the intrinsic value of biodiversity and natural ecosystems, and protect and restore them. — Principle 4: Enable communities to minimise their ecological footprint. — Principle 5: Build on the characteristics of ecosystems in the development and nurturing of healthy and sustainable cities. — Principle 6: Recognise and build on the distinctive characteristics of cities, including their human and cultural values, history and natural systems. — Principle 7: Empower people and foster participation. — Principle 8: Expand and enable cooperative networks to work towards a common, sustainable future. — Principle 9: Promote sustainable production and consumption, through appropriate use of environmentally sound technologies and effective demand management. — Principle 10: Enable continual improvement, based on accountability, transparency and good governance.	Complies Principle 1: The Proposal supports the long-term vision for St Marys, as it provides additional access that supports the existing and future development Principle 2: The Proposal supports the long term economic and social security, as it provides an additional road link for transportation and emergency access Principles 3-5: A comprehensive biodiversity assessment has been undertaken for the Proposal (refer to Appendix B). As a result, the road design was modified and biodiversity exclusion zones were established to recognise and ecological values. Principle 6: The Proposal recognises and is generally compliant with the specific controls for its individual precinct in St Marys. Principles 7-8: Lendlease has consulted Penrith City Council, RMS, OEH and surrounding landowners and the Proposal will be exhibited as part of the DA process. Principle 9: A waste management plan will be prepared and lodged as part of this DA Principle 10: Penrith City Council provided clear and comprehensive information regarding the development process and their standards, that informed this Proposal.

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
1.1.1 Site analysis	"Site analysis should include plan and section drawings of the existing features of the site at the same scale as the site and landscape plan." This Section in the DCP also specifies the minimum elements to be included in the plan, and notes that "not all of the elements listed above will be relevant for every development or site."	<u>Complies</u> The plan and section drawings have been prepared for this Proposal in accordance with the pre-DA lodgement advice provided by Penrith City Council. This includes: — Property Adjustment/Acquisition Plans — Road designs and civil design drawings — Survey drawing — Site plan — Stormwater Concept Plan/Details — Landscape/planting plan. Additional figures to assist with site analysis have been provided in this SEE.
1.1.2 Key Areas with Scenic and Landscape Views	New proposals on land identified in the LEP Scenic and Landscape Values Map (including gateway sites) or on land zoned E1 National Parks and Nature Reserves or E2 Environmental Conservation, are to submit a visual impact assessment with their development application. This assessment involves describing, analysing and evaluating the visual impacts of the proposed development, and identifying measures to minimise the impacts and ensure the development is sympathetic to the scenic and landscape character of the area.	The majority of the Proposal is on land identified in the LEP Scenic and Landscape Values Map. However, as discussed with Penrith City Council at the pre-DA lodgement meeting on the 27 September 2018, the Proposal would have minimal visual impact as it is a road at ground level within an industrial area, so a visual impact assessment is not required.

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
C1 D.1) Lighting	**a** "All areas intended to be used at night should allow appropriate levels of visibility. **b** Pedestrian pathways, lane ways and access routes in outdoor public spaces should be lit to the minimum Australian Standard of AS1158. Lighting should be consistent in order to reduce the contrast between shadows and illuminated areas. Lighting should be designed in accordance with AS4282 – Control of the obtrusive effects of outdoor lighting. **c** Lighting should have a wide beam of illumination, which reaches to the beam of the next light, or the perimeter of the site or area being traversed. Lighting should clearly illuminate the faces of users of pathways. **d** Streetlights should shine on pedestrian pathways and possible entrapment spaces as well as on the road. **f** Lighting should take into account all vegetation and landscaping that may act as an entrapment spot. **g** Lighting should be designed so that it is "vandal tough" or difficult for vandals to break."	Complies The Proposal incorporates lighting along the length of the upgraded and extended road section in accordance with the relevant standards. This includes sufficient lighting to illuminate the area for pedestrian pathways.
C2 Vegetation Management **C 3. Submission Requirements**	**a** "An application for development consent may require different levels of information, depending on: **i** the location and extent of the proposed works; and **ii** whether the site contains any threatened species, population, ecological community or its habitat. The level of information required to be submitted with the application will also depend on these factors. The level of information required to be submitted with the application will also depend on these factors. **b** Table C2.1 provides a guide only. Applicants should consult with Council's Development Services Department or Tree Management Officer for advice."	Complies A flora and fauna assessment in accordance with the transitional arrangements has been prepared to support the DA for this Proposal (provided in Appendix B). Penrith City Council confirmed that this is the appropriate level of information for the Proposal in the pre-DA lodgement meeting minutes.
C2 Vegetation Management **C 3. Submission Requirements**	**d** "In most cases, where works are proposed to any indigenous vegetation and require a development application, a flora and fauna assessment will be required. The report must be undertaken by a suitably qualified and experienced person (refer to definition in Appendix F1 – Definitions and Appendix F5 – Technical Information) and must be prepared in accordance	Complies The flora and fauna assessment prepared for the Proposal was undertaken by qualified and experienced ecologists (refer to Section 2.2 in Appendix B). It was

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
	with the Threatened Species Assessment Guidelines – The Assessment of Significance for the *Threatened Species Conservation Ac*t (DECCW (OEH) 2007), the Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft) (DEC, 2004), and the Significant Impact Guidelines – Matters of National Environmental Significance for the *EPBC Act* (prepared by the Commonwealth Department of Environment, Water, Heritage and the Arts, 2013). This report must include the following as a minimum: **i** A written and mapped description of the plant and animal species present and their habitats; **ii** A clear site plan showing, as a minimum, the proposed development and any associated Asset Protection Zone and Effluent Management Area, location of all vegetation, important site features and location of any vegetation to be removed. **iii** A statement of whether any of the plant and animal species or their habitats are listed as threatened, endangered or vulnerable species or communities under the *Threatened Species Conservation Act 1995* or the *Fisheries Management Act 1994*. **iv** A description of the proposed vegetation works and, if the works are to be undertaken as part of the proposed development, a description of the proposed development, including measures to mitigate adverse impacts; **v** An objective assessment to determine whether the proposed works and development are likely to significantly affect any threatened species, populations or ecological communities or their habitats. This assessment is required under Section 5A Significant effect on threatened species, populations or ecological communities or their habitats, of *Environmental Planning and Assessment Act 1979*. Section 5A lists the factors that must be taken into account in making such a determination; and **vi** Consideration of the likely impacts the proposed works or development may have on any potential use of the vegetation as a fauna movement corridor. Where relevant, consideration of the importance of any rural dams for fauna habitats. The location of any APZ or Effluent Management Area should also be considered by the assessment.	prepared in accordance with the relevant guidelines and legislation. Penrith LGA is classified as an interim designated area under Part 7 Reg 27 of the Biodiversity Conservation (Savings and Transitional) Regulation 2017 and as such former planning provisions continue to apply to pending or interim planning applications that are submitted before 24 November 2018. Given the proposal is not considered likely to lead to a significant impact on threatened species, populations, ecological communities or their habitats, a Species Impact Statement (SIS) is not required to support this Proposal.

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
C2 Vegetation Management **C 6. Site Planning and Design**	"The following controls apply where the removal of trees and other vegetation is proposed as part of a development application for a proposed use permissible under the relevant zone of Penrith LEP 2010: **a** The siting and layout of a development should consider, at the initial concept stage, the location of trees and other vegetation and favour their retention. **b** Buildings, Asset Protection Zones and Effluent Management Areas are to be sited on existing cleared land, where possible. **c** Where a stand of trees is to be retained, any associated native understorey should also be retained. **d** Trees and vegetation should be retained on steeply sloping sites (slopes greater than 20%) or where there is unstable soil to minimise erosion or geo-technical instability. (See also the controls in the Land Management section of this Plan relating to Geotechnical Stability). **e** Trees and vegetation must be retained along watercourses (See also the controls in the Water Management section of this Plan, relating to Riparian Corridors). **f** An application is required to address the effect of the proposed development on existing vegetation, the landscape character and the scenic quality of the locality. **g** Trees and vegetation must be retained where they shield existing or proposed buildings from views from public areas. **h** h) Trees and vegetation must be retained where they form part of the landscape character of an area, including on or near ridgelines. **j** Hard (or impervious) surfaces are not permitted under the drip line of any tree. The term 'drip line' is defined in Appendix F1 – Definitions. **k** Services (and particularly pipes carrying water/moisture) must not be located in the drip line of an existing tree. **l** Wherever trees or vegetation are removed (with consent) as a consequence of the development, an equal or greater number of replacement trees that grow to a similar or greater	<u>Complies</u> The Proposal concept design considered the importance of retaining trees and associated vegetation where possible. This led to the selection of compound sites on existing cleared areas, the establishment of vegetation exclusion zones and an adjustment to the road design to avoid unnecessary vegetation impacts where possible. It is not considered practical to replace the trees/vegetation removed, as the surrounding land is already highly vegetated.

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	height or canopy should, where practical, be incorporated into the landscaping design of the new development. **m** The siting and layout of a development should also consider, at the initial concept stage, bushfire risk. (See '2.3 Bushfire Management' below)."	
C2 Vegetation Management **7. Protection of Trees During Construction**	**a** "During construction, an adequate fence or similar structure must be constructed around any trees or vegetation to be retained, at a distance at least equal to the drip line. This area must not be used by machinery, for stockpiling wastes or for storage of any building materials. This will help protect the tree or vegetation from soil compaction and contamination; root, trunk and limb damage; and changes in surface levels that affect the health of the tree or vegetation. (See the Landscape Design section of this Plan for further details). **b** Tree protection must be in accordance with Australian Standard AS 4970-2009 Protection of trees on development sites."	Complies During construction of the Proposal, fences will be erected around the vegetation to be retained, particularly the vegetation exclusion zones shown on Figure 3.1.
2.3. Bushfire Management **C.2. Bushfire Assessment Report**	**a** A Bushfire Assessment Report, prepared in accordance with the PBP, must accompany all development applications on land identified as bush fire prone land. (For report requirements, see Appendix F3 – DA Submission Requirements).	The Proposal is situated on land identified as bushfire prone land. However, it is a road development so is unlikely to be affected by bushfire or increase likelihood of bushfires in the area. Therefore, as confirmed in the pre-DA lodgement meeting with Penrith City Council, a Bushfire Assessment Report is not required to accompany the DA for this proposal.

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
3.2. Catchment Management and Water Quality C.2) Addressing Potential Catchment Impacts	All applications to Council, where there is the potential to impact upon a water system, are required to identify in the application the relevant water systems in the catchment area of the site that may be affected and address how any potential impacts will be mitigated/avoided.	Complies Potential impacts on surface water have been discussed in this SEE (refer to Section 5.2.3.2 and 5.2.3.3). As part of the WSUD strategy, proprietary water quality improvement devices have been provided at the longitudinal drainage outlets to ensure that South Creek and its tributaries are protected against spills occurring on the new pavement. The design has also incorporated drainage upgrades and adjustments to ensure any potential impacts are mitigated/avoided (refer to Chapter 6).
C3 Water Management Table C3.1 Developments Required to Consider Water Sensitive Urban Design	Development types required to meet water conservation and stormwater quality and quantity targets are defined in Table C3.1. The performance criteria required to be met are listed below under subsection '5) WSUD Development Controls'. Affected developments must submit a WSUD Strategy (report dealing with measures to be implemented as part of the development) with a Development Application. A WSUD Strategy is a written report detailing potable water savings and stormwater quality and quantity control measures to be implemented as part of a development. The required content of the Strategy is outlined in Council's WSUD Technical Guidelines. When preparing supporting documentation for a development application or construction certificate application, Council requires applicants and developers to engage appropriately qualified and experienced practitioners for the development of appropriate WSUD designs and strategies. Discussion with Council is encouraged at an early stage of a development proposal to agree on a general design approach before a detailed WSUD Strategy is prepared.	Complies The Proposal satisfies the development type "Any development which results in an increase of the existing impervious area by greater than 250m^2. Development includes but not limited to additional roads, driveways, vehicle parking areas, manoeuvring areas, loading and storage areas" in Table C3.1. Therefore, The Water Conservation 5(a), Stormwater Quality 5(n) and Water Quantity Flow 5(c) performance criteria apply. A Water Sensitive Urban Design Strategy will be prepared and lodged as part of the DA in accordance with this requirement.

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C3 Water Management B. Stormwater quality	**Performance Criteria** Stormwater quality requirements for all development types identified in Table C3.1 are: **a** Pollution load reductions: **i** 90% reduction in the post development mean annual load total gross pollutant (greater than 5mm); **ii** 85% reduction in the post development mean annual load of Total Suspended Solids (TSS); **iii** 60% reduction in the post development mean annual load of Total Phosphorus (TP); **iv** 45% reduction in the post development mean annual load of Total Nitrogen (TN); **v** 90% Free Oils and Grease with no visible discharge. **b** Modelling for the determination of the mean annual loads of land uses must be undertaken in MUSIC and in accordance with the associated WSUD Technical Guidelines. **c** Any changes to the flow rate and flow duration within the receiving watercourses as a result of the development shall be limited as far as practicable. Natural flow paths, discharge point and runoff volumes from the site should also be retained and maintained as far as practicable. **d** Impervious areas directly connected to the stormwater system shall be minimised. Runoff from impervious areas such as roofs, driveways and rainwater tank overflows shall be directed onto grass and other landscaped areas designed to accept such flows.	Stormwater concept plan/details have been prepared for the DA to show how the required stormwater quality requirements would be met by the design. The full drainage and stormwater design details will be developed during detailed design. As discussed with Penrith City Council, MUSIC modelling is not required for this Proposal.
C3 Water Management C. Stormwater Quantity – Stream Forming Flows	**Performance Criteria** **a** The post development duration of stream forming flows shall be no greater than 3.5 times the pre developed duration of stream forming flows. The comparison of post development and pre development stream flows is commonly referred to as the Stream Erosion Index (SEI). The approach to evaluating the SEI is outlined in the associated WSUD Technical Guidelines.	Stormwater concept plan/details have been prepared for the DA to show how the required stormwater quality requirements would be met by the design. The full drainage and stormwater design details will be developed during detailed design.

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
C3 Water Management 3.3. Watercourses, Wetlands and Riparian Corridors C1) Controlled Activity Approval under the Water Management Act 2000	If any activities/land uses are proposed near a watercourse, the *Water Management Act 2000* may apply and you may be required to seek a Controlled Activity Approval from the Office of Water. Please consult with this Office regarding your proposal. Except for certain exemptions, you are likely to need a controlled activity approval for: **a** The erection of a building or the carrying out of a work (within the meaning of the *Environmental Planning and Assessment Act 1979*) on the bank or shore of any river, estuary or lake or within 40m from the top of its bank or shore; **b** Excavation in a river, estuary or lake, or within 40m from the top of its bank or shore; **c** Removal of material (including vegetation) from the bank or shore of any river, estuary or lake or from within 40m from the top of the bank or shore; **d** Deposition of material, whether by way of landfill operations or otherwise on or within the bank or shore of any river, estuary or lake or within 40m from the top of the bank or shore; **e** Anything which affects the quantity or flow of water in a water source, or is likely to do so. Even if there is an exemption from the requirement for an approval from this Office, you may still require the approval of Council. You may also require approval from Fisheries (NSW).	Complies As discussed in Section 4.2.3 and confirmed in the Penrith City Council pre-DA lodgement meeting minutes, a controlled activity approval from the Office of Water would be required for this Proposal. This approval would occur through the DA process as integrated development.
C3 Water Management 3.3. Watercourses, Wetlands and Riparian Corridors C.2) Preserving Alignment of Watercourses	**a** Where possible, the natural (or historic) alignment of an existing wetland or watercourse should be retained along with its natural dimensions and flow regimes. **b** Watercourses should not be straightened to reduce the natural meander or flow path or to improve flood conveyance. **c** The alignment of major overland flow paths should be recognised in site planning and development design.	Complies Where possible, the existing culverts, watercourses and overland flow paths have been maintained in the design.

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C3 Water Management 3.3. Watercourses, Wetlands and Riparian Corridors C.3) Avoiding Modifications to Natural Waterbodies	**a** There should be no modifications to a natural (or historic) waterbody in its dimensions, depth or bank height unless it seeks to enhance the ecological outcomes of the waterbody. **b** Watercourses should not be modified to maximise flood conveyance unless there are no other means to avoid damage to existing dwellings or infrastructure that cannot be relocated. **c** Natural hydrological processes are to be maintained where possible, including natural vegetation and the flow regimes to maintain creek line stability and the health of terrestrial and aquatic plant communities.	<u>Complies</u> Where possible, the existing waterbodies have been maintained in the design.
C3 Water Management 3.3. Watercourses, Wetlands and Riparian Corridors C.4) Protection and Enhancement of Riparian Corridors	**a** All riparian corridors should comprise a vegetated riparian zone along each side of the waterway (see Figure C3.1). **b** The vegetated riparian zone should retain or be vegetated with, fully structured native vegetation (trees, shrubs and groundwater species). **c** In relation to activities within the vegetated riparian zone, such as cycleways and paths, detention basins, stormwater management devices and essential services, compliance is required with the 'riparian corridor matrix' in the NSW Office of Water's Guidelines for riparian corridors on waterfront land (July 2012). **d** A managed buffer zone outside the vegetated riparian zone should be provided (where possible), to provide an additional buffer between development and the vegetated riparian zone. Land uses within the managed buffer zone could include roads, paths, playgrounds and stormwater management devices. **e** Asset protection zones should be located outside the vegetated riparian zones. **f** Appropriate widths for vegetated riparian zones will depend on the specific ecosystems being managed. Council's approach to determining the Order of Stream is based on the Strahler methodology, which is consistent with the NSW Office of Water. Council reserves the right to assess each riparian corridor and each development on its merits. In general, however, the width will depend on the order of the stream/watercourse (see Figure C3.2) which provides an indication. The width should be measured from the top of the highest bank on both sides of the stream/watercourse, excluding any managed buffer zone, and shall comply with the requirements outlined in Table C3.3.	The Proposal footprint includes an unnamed tributary of South Creek. Where possible, the design has avoided removal of vegetation within the riparian zone. Hydrology and design flows will be undertaken during detailed design to ensure protection and enhancement of riparian corridors where possible.

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	Where, a watercourse has had a gabion wall or channellisation constructed, this should be removed to restore a natural meander for ecological purposes, except where: **i** The length of the watercourse through the development site is less than 50m; or **ii** The watercourse through the development site is a middle section of the overall watercourse, and it is technically unfeasible to reverse the channellisation; or **iii** Restoring the natural meander will create a hazard. Enhancement of riparian corridors should, where possible: **i** Mimic natural hydrological regimes for watercourse treatments; **ii** Replicate the natural watercourse through creation of a meandering channel, rather than straight channels; **iii** Simulate natural roughness having regard to riparian requirements and flow velocities to sustain vegetation groupings; **iv** Minimise ongoing maintenance requirements through channel design; **v** Establish a functional riparian zone and natural channel section; **vi** Maintain or create a full assemblage of vegetation with likely natural obstructions; **vii** Create variations in channel cross-section and provide an opportunity for meandering of the channel within the flood plain; **viii** Minimise likely damage to channel banks and vegetation from storm flow through channel design; and **ix** Ensure that the channel has the capacity for appropriate flood flows having regard to the steepness of the catchment; channel modifications and future liability for land owners, Council and government agencies. There may be a need for a sensitivity analysis for a range of flood hydrology and design flows having regard to supporting flood studies for development.	

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
C3 Water Management 3.5 Flood Planning 1) Submission Requirements	**a** Where relevant, a comprehensive flood study, incorporating: **i** a survey of the main watercourse; **ii** a survey of the site; and **iii** a detailed flood and drainage investigation which establishes the estimated 1% AEP (100 year ARI) flood level; is to be submitted with any development application on land identified as fully or partially flood affected. The levels on the survey are required to be verified during construction by a survey certificate. **b** The applicant shall be required to demonstrate to the satisfaction of Council (on the basis of a qualified consultant report) that: **i** The development will not increase the flood hazard or risk to other properties; **ii** The structure of the proposed building works shall be adequate to deal with flooding situations; **iii** The proposed building materials are suitable; **iv** The buildings are sited in the optimum position to avoid flood waters and allow safe flood access for evacuation; **v** The proposed redevelopment will not expose any resident to unacceptable levels of risk or any property to unreasonable damage; and **vi** Compliance of any existing buildings with the Standard - Construction of Buildings in Flood Hazard Area and the accompanying handbook developed by the Australian Building Codes Board (2012).	The Proposal is affected by mainstream flooding from South Creek and is within flood planning area as shown in the Penrith LEP. The road has been designed so that it would be flood free in a 5% AEP flood event from South Creek as per the pre-DA lodgement meeting minutes. The design has also been informed by a Comprehensive Flood Study that was undertaken by Jacobs for the adjacent East West Connector project (Jacobs, 2018). The Proposal does not involve the construction of any buildings.
C3 Water Management 3.5 Flood Planning 13) Overland Flow Flooding	**a** Council has undertaken a Penrith Overland Flow Flood 'Overview' Study. Consideration must be given to the impact on any overland flow path. Generally, Council will not support development obstructing overland flow paths. Development is required to demonstrate that any overland flow is maintained for the 1% AEP (100 year ARI) overland flow. A merit based approach will be taken when assessing development applications that affect the overland flow. **b** Council's Stormwater Drainage Specification for Building Developments provides information on the details required in the preparation of an overland flow study.	Overland flow paths have been considered in the Proposal design.

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
3.6. Stormwater Management and Drainage C.1) Natural Environment	**a** Runoff must not be discharged into bushland areas, including threatened ecological communities. **b** Pipe outlets shall be treated with measures to dissipate stormwater velocity, except where waters enter a formed channel or similar structure that is unlikely to be damaged by water flowing in at high velocity. **c** Permeable ground surfaces are to be maintained as far as possible, and where suitable conditions exist, stormwater is to be infiltrated on-site.	Complies A stormwater concept plan and report prepared in accordance with the relevant guidelines will be submitted with the DA.
3.6. Stormwater Management and Drainage C. 2) Drainage	**a** Council's Stormwater Drainage Specification for Building Developments provides details on drainage requirements including on-site detention, new drainage systems and the like. **b** The development of any lot should take into account the existing drainage patterns of the area, including any localised ponding, and whether the proposed development is likely to affect: **i** Access to the site; **ii** Drainage on adjoining properties; **iii** Localised nuisance flooding on adjoining properties; and **iv** Natural overland flow or drainage paths. **c** In areas where there are no defined drainage patterns, Council may require the applicant to liaise with the adjoining owners regarding the construction of a drain or channel to an existing watercourse. This may include the provision of drainage easements. **d** Depending on the scale of the proposed development, the applicant may be required to address the following matters in their application: **i** The drainage capacity available for the site (e.g. if the site is connected to a centralised stormwater system, the existing drainage network capacity); **ii** Where capacity may be limited, appropriate drainage measures, including possible on-site detention (determined by liaising with Council's Development Engineering Unit and receiving detailed advice from a qualified engineering consultant); **iii** If the site is affected by drainage constraints, the current stormwater discharge and likely future discharge. In this regard, a report prepared by a qualified engineer will be required	Complies A stormwater concept plan and report prepared in accordance with the relevant guidelines will be submitted with the DA. This will outline the drainage measures to be implemented as part of the Proposal. A description of the drainage to be provided as part of the Proposal is in Section 3.1.3.

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	and should demonstrate that the development will not overload trunk drains during peak storm events or cause localised flooding; **iv** If the proposed development will result in additional pollutant loading (and the appropriate licences have been obtained from the relevant government authorities), details demonstrating that the drainage systems have adequate capacity for those pollutants and runoff will comply with the water quality requirements referred to in this Plan; and **v** Any required easements across neighbouring properties. Where easements are required, Council requires the submission of the adjoining owner's consent with the development application. **e** If the site does not have access to Council's stormwater drainage system, all drainage should be designed to ensure that the intensity, quantity and quality of surface runoff is not detrimental to downstream properties and watercourses. A legal point of discharge will be required. **f** If the site has access to Council's stormwater drainage system, all roof and surface water that is not recycled for use on the site must be discharged into Council's stormwater drainage system. No surface drainage will be permitted to discharge across Council's footways or reserves or enter adjoining land. **g** The applicant should demonstrate how existing soil type and associated constraints (e.g. salinity and poor percolation) have been considered in the drainage design). <u>New Drainage Design</u> **a** Any new piped drainage system shall be designed to control minor stormwater flows under normal operating conditions for an ARI of 5 years. **b** Any new drainage system shall be designed to control major stormwater flows under normal operating conditions for an ARI of 100 years.	

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C4 Land Management 4.1. Site Stability and Earthworks C3) Development Application Requirements	**a** Any development application that proposes earthworks and therefore changes to the levels of a site, is required to clearly address the following in the Statement of Environmental Effects or a Geotechnical Report (if required, see 3 b): **i** The location and extent of the earthworks on the site; **ii** Justification for the need to change the land levels in terms of the overall development; **iii** Any other impacts from the changed land levels as a consequence of the earthworks. **b** Where a building is proposed on land where the existing slope gradient is higher than 15% (or the land is likely to be subject to any land stability issues), the development application may be required to include a Geotechnical Report (prepared by a suitably qualified consultant). **c** Council will not permit a building to be placed on land where the existing slope gradient before development is greater than 20%. **d** Applicants should refer to the following sections of this DCP: **i** Vegetation Management, to ensure vegetation is protected on the site, particularly where the vegetation is important to site stability; **ii** Site Planning and Design Principles, to ensure any proposed development responds to the natural topography of the site; and **iii** The other sections of this section relating to landfill, erosion and sedimentation, contaminated lands and salinity to determine if any additional information is required to address these issues.	Complies The proposed earthworks are described in Section 3.2.3 of this SEE. The resultant land levels will be shown on plans submitted as part of the DA. The earthworks are required to provide the required road grade. Vegetation management, site planning and design principles and other land management principles have been considered.
C4 Land Management 4.1. Site Stability and Earthworks C.4) Limitations on Earthworks	**d** During any earthworks, any topsoil should be preserved on site for re-use and should be stockpiled and covered to avoid dust or loss of topsoil. Refer to the Landscape Design Section of this Plan for controls on stockpiling topsoil on site.	Complies Where possible, removed topsoil will be preserved on site for re-use.

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C4 Land Management 4.3. Erosion and Sedimentation C.1) Erosion and Sediment Controls Plans (ESCP)	**a** All applications for subdivision and development which involve site disturbance must be accompanied by an Erosion and Sediment Control Plan (ESCP), except in the following circumstances: **i** The construction of minor structures including carports, pergolas, verandahs, garden sheds and the like; and **ii** Dwelling additions and alterations which are deemed by Council as not likely to cause erosion and sediment loss from the site. **b** An ESCP is necessary to ensure that a strategy to manage erosion and sedimentation is considered at an early stage in the planning process. The ESCP must consider the potential for soil erosion and sedimentation during all stages of the development – demolition, construction and operation of the development. The ESCP must demonstrate that appropriate controls have been planned which will, when implemented, minimise erosion of soil from the site and, accordingly, sedimentation of drainage systems and waterways. **c** The ESCP must be submitted in accordance with best practice guidelines for erosion and sediment control, including Landcom's, Managing Urban Stormwater – Soils and Construction, 2004. **d** Where the applicant is uncertain of the most suitable method of control for a particular situation, the applicant is requested to consult with Council officers to discuss the proposal prior to the submission of an ESCP.	Complies An erosion and sediment control plan will be prepared and lodged as part of the DA for this proposal. It will be prepared in accordance with the relevant guidelines.
C4 Land Management 4.3. Erosion and Sedimentation C. 2) Requirements for Erosion and Sediment Control	**a** Soil erosion and sediment control measures are to be provided on-site before the commencement of any earthworks or development activity, in accordance with the approved ESCP. These must be maintained throughout the course of construction until disturbed areas have been revegetated and the soil stabilised. The applicant will be required to provide certification to this effect, which is to be lodged with Council prior to construction. **b** All erosion and sediment control measures are to be installed to the satisfaction of Council or the proposed Certifier, in accordance with best management practices recommended by recognised authorities (including Managing Urban Stormwater – Soils and Construction).	Complies Soil erosion and sediment control measures will be implemented during construction of the proposal in accordance with the ESCP and the guidelines.

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	c The work supervisor is responsible for ensuring that all erosion and sediment control measures are implemented in accordance with conditions of approval and are maintained until a final inspection has indicated that the site is sufficiently rehabilitated and stabilised. **d** The decision to install a particular mechanism to prevent erosion and/or sedimentation depends on the location and type of activity proposed and may vary from site to site. **e** Council may require erosion and sediment control works to be carried out in addition to, or in variation from, the approved ESCP, should circumstances necessitate it. Any variations are to be approved by Council and implemented in accordance with this and Management section and current best practice guidelines (including Managing Urban Stormwater –Soils and Construction), where relevant. **f** All erosion and sediment control measures should be maintained for the duration of the specified maintenance period. An established, stabilised ground cover must be in place and approval should be obtained from the Certifying Authority before removing erosion and sediment control measures.	
C4 Land Management 4.3. Erosion and Sedimentation C. 3) Additional Measures for Large Sites	Where an application is for a site over 2,500m^2 and there will be substantial earthworks, the applicant is required to address a number of additional measures in the ESCP, including: **a** Identify all areas likely to cause pollution of waterways from the transport of stormwater run-off containing sediment and silt and implement appropriate devices to stop the risk of pollution; **b** Divert clean water around the construction site to prevent contamination; **c** Retain as much natural vegetation as possible and limit site disturbance; **d** Control stormwater that enters the construction site from upstream; **e** Divert stormwater from undisturbed upper slopes onto stable areas; **f** Retain and stockpile all excavated topsoil on site for future landscaping and to minimise risk of erosion; **g** Prevent sediment/silt from entering adjoining public or private property (especially drains) by installing sediment control devices at the low side of sites and wash down areas;	<u>Complies</u> The additional measures will be addressed in the ESCP prepared for the Proposal.

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	h Provide a single, stabilised entry/exit point to the site; **i** Prevent sediment, including building materials, from reaching the road or Council's stormwater system. Sediment is to be removed by sweeping, shovelling or sponging. Under no circumstances shall sediment be hosed; **j** Where a work zone permit over public property is applicable, ensure that appropriate debris control devices are implemented to prevent spillage of building materials into stormwater drains; **k** Compact all drainage lines when backfilling; **l** Connect downpipes to the stormwater system as early as possible; **m** Revegetate all disturbed areas, after on-site works are completed, in order to stabilise the surface; and **n** Maintain all sediment control devices during earthworks and construction to standards acceptable to Council.	
C4 Land Management 4.4.1. Preventing Contamination B. Controls	**1** Development applications for new or for expanding existing developments may be required to include information on the potential for the activity to contaminate. **2** Environmental impact assessments are required to address the potential and likelihood of contamination. **3** In assessing development applications for activities which could be potential sources of contamination, Council will ensure it is satisfied that the proposed technical and management controls will be adequate to prevent contamination. Conditions of consent may be imposed by Council to ensure adequate controls are applied to an activity or development.	Complies The potential for the Proposal to contaminate and/or encounter contamination has been discussed in Section 5.1.1.

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C4 Land Management 4.4.2. Triggers for Contamination Investigation B. Controls	**1** Any application must provide appropriate information relating to past, present and proposed land uses. **2** Council will evaluate the site's potential for contamination in accordance with procedures established by this section. If there is any indication of a past land use or activity that may have caused contamination, Council will require additional information to prove that the site is suitable for the proposed use. **3** Council may require any site investigation report or similar information submitted in support of an application to be referred to a site auditor for an independent review. The auditor shall be nominated by Council. All costs associated with the review shall be borne by the applicant. All communication with the auditor shall be either with the knowledge of Council or in the presence of Council officers.	Complies The potential for the Proposal to contaminate and/or encounter contamination has been discussed in Section 5.1.1. A relevant environmental investigation report has been provided in Appendix F.

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
C4 Land Management 4.5 Salinity C2) Salinity Controls	**a** Disturbance to the natural hydrological system shall be minimised by maintaining good drainage and reducing water logging on the site. **b** Groundwater recharge shall be minimised by such measures as: **i** Directing runoff from paved areas (roads, car parks, domestic paving, etc) into lined stormwater drains rather than along grassed channels as necessary; **ii** Lining or locating any water storages/ponds/drainage basins higher in the landscape to avoid recharge where proximity to the water table is likely to create groundwater mounding; and **iii** Encouraging on site detention of roof water runoff. **c** Soil erosion and sediment control measures, in accordance with erosion and sedimentation controls in this section, shall be incorporated into the development during its construction and following its completion. **d** Construction techniques shall be employed that prevent structural damage to the development as a result of salinity (see "Building in a Saline Environment"). For example, building footings shall be constructed so as not to impede groundwater movement and building materials that are resistant to salt effects shall be used. **e** The removal of vegetation, particularly native vegetation, on the site shall be minimised. **f** All landscape designs should undertake the following practices: **i** Select salt tolerant plant species (generally native trees and shrubs); **ii** Use mulch in all garden beds; **iii** Minimise the area of lawn as this requires large quantities of water; **iv** Use 'water wise' garden and landscape design (including timers, selection of plants with low water needs, grouping plants of similar water usage together, etc); and **v** Use non-corrosive materials when constructing pipes and channels. **g** All works are to conform with the Western Sydney Salinity Code of Practice, June 2003.	Complies Drainage, runoff, erosion and sediment controls, sensible building materials and landscape design has been considered as part of the Proposal design.

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C5 Waste Management 5.1. Waste Management Plans A. Controls	**1** Applicants are to submit a Waste Management Plan when lodging a development application for: **a** Demolition or construction of buildings; **b** Change of use of buildings for rural, residential, commercial and industrial developments; **c** Subdivision of land and/or buildings; or **d** Alterations to 50% or more of the existing gross floor area of buildings, or additions to buildings resulting in a 50% increase (or more) to the existing gross floor area. **2** The Waste Management Plan must be supported by scaled waste management drawings that are to assist in demonstrating compliance with the provisions of this Plan. **5** The Waste Management Plan must include details of: **a** The types and volumes of wastes and recyclables likely to be generated as a result of the development; **b** How waste and recyclables will be stored and treated on site; **c** How the residual non-reusable or non-recyclable wastes and recyclables are to be disposed of; and **d** How ongoing waste management will operate once the development is complete (for the life of the development).	Complies A Waste Management Plan will be prepared and lodged as part of the DA for this Proposal in accordance with the DCP requirements.
C5 Waste Management 5.3.1. Site Management	**1** Proposals involving demolition and/or construction (including earthworks) are to include a Waste Management Plan which addresses the following issues: **a** Minimising site disturbance and eliminating unnecessary excavation; **b** Where applicable, stripping topsoil from areas subject to excavation and storing it on site for re-use; **c** Identifying all waste likely to result from the works on site and opportunities for the reuse or recycling of materials;	Complies A Waste Management Plan will be prepared and lodged as part of the DA for this Proposal in accordance with the DCP requirements.

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	d Where construction is proposed, determining: **i** Opportunities for the use of prefabricated components and recycled materials; **ii** Approximate volumes of materials to be used and incorporating these volumes into a purchasing policy so that the correct quantities are purchased; **iii** Delivery arrangements of materials so that materials are delivered 'as needed' to prevent the degradation of materials through weathering and moisture damage; and **iv** Opportunities to return excess materials to the supplier or manufacturer; **e** Considering the method of demolition to be utilised so that selective deconstruction is implemented, enabling effective recycling of materials; **f** Identifying the area(s) on site to be used for the storage of materials, separating the areas for recycling and disposal (giving consideration to access, slope, drainage, location of waterways, stormwater outlets and vegetation); **g** Ensuring that separated materials are to be kept uncontaminated to guarantee the highest possible reuse value; **h** Considering where excess fill material will be disposed of, the quantity and quality of the excess material and the method of transport to be used; **i** Identifying and providing measures to prevent the occurrence of windblown litter, dust and stormwater pollution; **j** Where applicable, ensuring that: **i** Contractors are arranged for the transport, processing and disposal of waste and recycling; and **ii** Evidence, such as weighbridge dockets and invoices for waste disposal or recycling services, is retained and available for presentation to Council Officers upon request.	

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C5 Waste Management 5.3.2. Selection of Building Materials	**1** Choose materials with low embodied energy properties and/or materials that have been salvaged/recycled for the construction/fit out of the development. Relevant materials and their potential for re-use and recycling from Table C5.1 include — Concrete: Re-used for filling, levelling, or road base — Overburden: Power screened and used as top soil — Green waste: Can be used for mulching, composting — Excavated material: Re-used on site or disposal to approved site	Complies Where possible, materials will be assessed for their potential for re-use and recycling during construction of the Proposal.
5.3.3. Designing for Waste Minimisation	**1** The design of developments should incorporate principles on how waste can be minimised in the design by: **a** Incorporating the use of modular components; **b** Minimising excavation and fill (See the "Land Management" section of this Plan); **c** Using prefabricated frames, trusses and cladding; **d** Using standard material sizes or negotiating with manufacturers for the supply of non-standard material sizes; **e** Selecting materials that do not require finishes; **f** Grouping wet areas together to minimise the amount of pipe work required; **g** Implementing measures to prevent the occurrence of windblown litter, dust and stormwater pollution; **h** Incorporating existing trees/shrubs into the landscape plan; **i** Designing for de-construction; **j** Incorporating facilities for the source separation of wastes and recyclables (both internal and external); **k** Designing waste storage areas complementing the development and the surrounding streetscape.	Complies Where possible, the proposal has considered the principles of waste minimisation through design – such as aiming to minimise excavation and fill and incorporating existing tree/shrubs.

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<table>
<tr><th>SECTION IN DCP</th><th>REQUIREMENT</th><th>COMPLIANCE ASSESSMENT</th></tr>
<tr>
<td>C6 Landscape Design
6.1 Controls 6.1.1. Development Process</td>
<td>
1 Development Categories

This section classifies all development in the Penrith local government area into 3 categories (shown in Table C6.2). Each of these categories has different requirements in relation to the landscape design component of the development (i.e. different parts of this section apply to different types of developments)

2 Submission Requirements

Depending on the type of development proposed, different types of vegetation and landscaping information will be required as part of the development application. Table C6.3 lists the type of information to be submitted for the various categories of development.

Table C6.3
<table>
<tr><th>Required Information</th><th>Category 1</th><th>Category 2</th><th>Category 3</th></tr>
<tr><td>Site Analysis</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Tree Survey and Assessment Report/Arboricultural Survey Report</td><td>❖</td><td>❖</td><td>✓</td></tr>
<tr><td>Tree Management Plan</td><td>❖</td><td>❖</td><td>❖</td></tr>
<tr><td>Landscape Concept Plan</td><td>❖</td><td>✓</td><td>✓</td></tr>
<tr><td>Landscape Detail Plan and additional details</td><td></td><td>❖</td><td>✓</td></tr>
</table>
✓ Required Information
❖ Information may be required depending on the scale of the project, the site conditions and location. (Please discuss with Council).

a Detailed requirements for the information that must be addressed by these reports is set out in Appendix F3 of this DCP. All applicants should review and address these information requirements in their submissions.
</td>
<td>The Proposal would be classified as Category 3 in accordance with Table C6.2. In accordance with Table C6.3, this means that Site Analysis, Tree Survey and Assessment Report/Arboricultural Survey Report, Landscape Concept Plan and Landscape Detail Plan and additional details are required for the DA. However, given the nature of the Proposal, these have been confirmed not to be required by Penrith City Council.</td>
</tr>
</table>

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	b If more than one type of information is to be submitted with the development application, it may be appropriate for the information to be combined in the one plan or document. This depends on the scale and complexity of the proposal, and its potential impact on the environment and amenity. **c** Landscape plans must be prepared by a suitably qualified consultant. Landscape design consultants who are members of accredited organisations should be engaged to ensure professional standards are achieved. Accredited organisations include: Australian Institute of Landscape Architects and Australian Institute of Landscape Designers and Managers. **d** Landscape construction should be carried out by a qualified landscape contractor to ensure that adequate standards of workmanship are achieved. Landscape contractors who are members of the Landscape Contractors Association of NSW should be engaged where possible.	
C6 Landscape Design 6.1.2. Protection of the Environment	**1 Environmentally Sustainable Design** **2 Soil Landscapes** **3 Minimising Soil Erosion** **4 Avoidance of Excavation and Filling** **5 Conserving Site Soil** **6 Species Selection** **7 Bushfire Resistant Species** **8 Protection of Trees and Vegetation on Construction Sites and Adjoining Public and Privately Owned Land** **a** If a Tree Management Plan is required, it must identify the vegetation that is to be retained with the development and how it will be protected during and after construction. Tree protection measures must be in accordance with Australian Standard AS4970-2009 Protection of trees on development sites.	<u>Complies</u> The Proposal would predominantly involve protection of existing trees and vegetation communities surrounding the Proposal. No new landscape design, beyond protecting and restoring the native vegetation would be proposed. Therefore, the controls outlined in Sections 1-7 and 12-13 would not apply. A flora and fauna assessment report has been provided in Appendix B. A tree management plan will be prepared prior to construction.

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	b Where existing vegetation is to be retained, that vegetation must be protected from soil compaction, root, trunk and limb damage, soil contamination and changes in surface levels that affect the health of the vegetation. **c** The Tree Management Plan is to be in place prior to commencement of any site works. "Site works" includes the demolition of existing structures or the entrance onto the site of any machinery for excavation, demolition or large scale rubbish removal. Protection measures are to be installed prior to the commencement of any site work in accordance with Australian Standard AS4970-2009 Protection of trees on development sites. **d** Trees, vegetation and their root zones on public property and private land adjacent to the development site may also need to be protected during the construction process. A common example of this is the protection of street trees located in the public footpath. These trees and vegetation will also need to be included in the Tree Management Plan and protected in accordance with its recommendations. **9 Vegetation Communities** **a** In some cases, there may be sites that contain remnant native vegetation. Where remnant native vegetation exists on a site, a flora and fauna assessment report will be required. (See the 'Vegetation Management' section of this Plan for further details). The purpose of the flora and fauna assessment report is to determine whether the proposed development, including landscaping works, are likely to significantly affect any threatened species, populations or ecological communities or their habitats listed under the *Threatened Species Conservation Act 1995*. **12 Salinity** **13 Materials Selection**	

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C6 Landscape Design 6.1.3. Neighbourhood Amenity and Character 1) Landscape Character	**a** Landscape design should reinforce the identified natural attributes of the site including, but not limited to, watercourses, landmark elements, landforms, views and vistas, significant trees, vegetation patterns and historic buildings. **b** Remnant native vegetation should be retained, managed and incorporated into landscape designs to conserve the natural biodiversity across the landscape. **c** Landscape design should enhance the amenity and visual quality of the site. Landscaping solutions are to be used to screen and enhance visually obtrusive land uses or building elements within their setting.	Complies The Proposal would predominantly involve retaining and managing the remnant native vegetation surrounding the Proposal footprint.
6.1.3. Neighbourhood Amenity and Character 3) Streetscape	**a** All sites make a contribution to the streetscape by way of the design of any structures or vegetation. Therefore, any landscape submission must include an assessment of the streetscape. **b** Generally, Council requires that dominant positive streetscape elements are to be continued in the design of any landscaping works to ensure that the development integrates into and enhances the existing streetscape character. Features that contribute to the existing streetscape include: **i** Street trees and vegetation; **ii** Pavement materials/details; **iii** Architectural character; **iv** Setbacks of buildings and other structures; **v** Existing uses, e.g. residential/retail/industrial; **vi** Heritage items; **vii** Traffic – vehicular and pedestrian; **viii** Car parking – off street, on street, access, etc; **ix** Privacy; **x** Building heights, mass, material and colour; **xi** Links with other spaces; **xii** Street dimensions/scale – street width, verge and path treatments; **xiii** Lighting; **xiv** Maintenance issues, e.g. rubbish collection, letterboxes;	Complies The Proposal's impact on the surrounding streetscape is assessed in Section 5.2.1. This includes consideration of vegetation, pavement materials, traffic, car parking, lighting and street furniture.

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	xv Landscape style; and **xvi** Street furniture, fences, gates and signage.	
C7 Culture and Heritage 7.1.5. Development in the Vicinity of a Heritage Item or Conservation Area C Controls	**1** A Heritage Impact Statement shall be lodged with a development application for buildings or works in the vicinity of a heritage item or heritage conservation area. This clause extends to development that: **a** May have an impact on the setting of a heritage item or conservation area, for example, by affecting a significant view to or from the item or by overshadowing; or **b** May undermine or otherwise cause physical damage to a heritage item; or **c** Will otherwise have any adverse impact on the heritage significance of a heritage item or any heritage conservation area within which it is situated. **2** The following issues must be addressed in the Heritage Impact Statement: **a** The impact of the proposed development on the heritage significance, visual curtilage and setting of the heritage item; **b** Details of the size, shape and scale of, setbacks for, and the materials to be used in, any proposed buildings or works; and **c** Details of any modification that would reduce the impact of the proposed development on the heritage significance of the heritage item.	Complies Section 5.2.2 includes a heritage impact statement for the works in the vicinity of Dunheved Homestead.
C8 Public Domain 8.3 Lighting C) Controls	**2** As a minimum, the requirements of AS 1158 Lighting for roads and public spaces should be used for street lighting. AS 1158 may also be used for the lighting of pathways, laneways and access routes provided the lighting design allows: **a** A wide beam of illumination to reach the beam of the next light, or the perimeter of the site or area being traversed; and **b** The faces of users travelling along the path/laneway/arcade up to a distance of 15m are clearly illuminated.	Complies The Proposal includes street lighting that satisfies the requirements of AS 1158.

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C10 Transport Access and Parking 10.2 Transport Management and Safety B.1) Traffic Studies	Traffic studies may be required for some developments. Check with Council about whether a traffic report is required to support your proposal. **a** Development applications for major development proposals should be accompanied by an appropriate Traffic Report (see Appendix F3 – Submission Requirements for further details). The Traffic Report should detail the assessed impact of projected pedestrian and vehicular traffic associated with the proposal, with recommendations on the extent and nature of the traffic facilities necessary to preserve or improve the safety and efficiency of the adjacent road system. **b** A Traffic Report must be provided for applications required to be referred to the Roads and Maritime Services (RMS) under Column 2 and a Traffic Impact Statement for Column 3 of *SEPP (Infrastructure) 2007*. **c** Depending on the scale, type and nature of the use proposed, Council may determine that a Traffic Report or Traffic Impact Statement is required for certain development which is not listed under Column 2 or 3 of *SEPP (Infrastructure) 2007*. **d** Any Traffic Report or Traffic Impact Statement is required to address the following issues: **i** The objectives of this section relating to transport and land use; **ii** The objectives of this section relating to traffic management and safety; **iii** The objectives and controls of this section relating to traffic generating developments **iv** The issues set out in Appendix F3 – Submission Requirements of this DCP. **e** Any development identified in Schedule 3 of State Environmental Planning Policy (Infrastructure) 2007 is either referred to RMS (Column 2 developments) or Council's Local Traffic Development Committee (Column 3 developments) for assessment and conditions as required.	Complies A traffic impact study for the Proposal to support the DA has been provided in Appendix C.

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C10 Transport Access and Parking 10.2 Transport Management and Safety B. 2) Road Safety	**a** Each development should demonstrate how it will: **i** Provide safe entry and exit for vehicles and pedestrians which reflect the proposed land use, and the operating speed and character of the road; **ii** Minimise the potential for vehicular/pedestrian conflicts, providing protection for pedestrians where necessary; **iii** Not restrict traffic flow or create a hazard to traffic on roads in the vicinity of the development; **iv** Provide suitable off-street parking facilities to accommodate vehicles generated by the development; and **v** Identify the need, where apparent, for any additional on-street traffic facilities or road works which may be required to maintain the safe and efficient movement of vehicles and pedestrians. **b** Where feasible, vehicle access for developments should be from service roads/lanes. **c** The design of direct vehicular access to developments should consider the traffic impacts on the surrounding road network. This may require the provision of deceleration, acceleration, right turn lanes and road widening, as necessary. **d** Provision must be made for all vehicles to enter and leave properties in a forward direction other than for single dwellings. **e** The layout and design of parking areas must minimise vehicle to pedestrian impacts, especially where heavy vehicle access to loading docks is proposed.	Complies The road design drawings and supporting information provided as part of the DA have been prepared to demonstrate vehicle access and road safety.
C10 Transport Access and Parking 10.3 Key Transport Corridors C) Controls	**1** Character of Key Transport Corridors **a** Applicants need to ensure that the proposed development is in character with each of the key transport corridors. **b** Access driveways and development in proximity to the key transport corridors need to protect the landscape character and any heritage values, and ensure traffic safety.	Complies The Proposal involves works on Christie Street, which is defined as a Key Transport Character. It has been designed to ensure the function of Christie Street is maintained (or enhanced).

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
C10 Transport Access and Parking 10.4 Roads B. Controls	**1** Controls for all roads **a** Proposed roads must comply with the road configurations set out in Table C10.1. These configurations apply to private and community title roads as well as all public roads. **b** In special circumstances where it can be clearly demonstrated that the road configurations in Table C10.1 are not appropriate, then the following key principles must be applied to any alternative proposal: **i** Road and lane widths must allow for two-way movement and turning movements of design vehicles, including consideration for buses, heavy vehicles, garbage trucks and emergency vehicles; **ii** Verge widths must consider requirements for utilities, street tree planting, footpaths, shared paths and urban design outcomes; **iii** Adequate on-street parking must be provided; **iv** Adequate turning paths must be provided for all design vehicles at intersections and for property access; **v** Road widths must be set to minimise kerbside restrictions and regulatory signage; **vi** Sufficient width must be provided for specialist drainage functions; and **vii** Life cycle costs for construction and maintenance must be minimised.	Complies The road design for the Proposal has been prepared in accordance with the required guidelines and the road configurations have been agreed with Penrith City Council.
C10 Transport Access and Parking 5) Industrial roads	**a** Industrial roads are to achieve the following performance objectives: **i** Provide direct access to industrial properties and interconnectivity with the adjoining road network; **ii** Provide for all classes of heavy vehicles and appropriate circulation; **iii** Provide dedicated on-street parking on both sides of the road; **iv** Provide a shared path or on road cycle ways; and **v** Provide lighting in accordance with relevant Australian Standards. **b** Roads are to be designed in accordance Penrith City Council's Engineering Design Guidelines and conditions of development consent with reference to Figure C10.5. **c** Further controls may be applied as part of a development consent based on the individual circumstances of any proposed layout with reference to the adjoining road network.	Complies The road design for the Proposal has been prepared in accordance with the required guidelines and the road configurations have been agreed with Penrith City Council.

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
C10 Transport Access and Parking 10.5.2 Access and Driveways B. 1) General requirements	**a** The road access to the site should provide for safe entry to and exit from the site. All vehicles must enter/exit the site in a forward direction. (This does not apply to single dwellings). **b** The entry and exit from the site should provide for appropriate traffic sight distance in both directions, in accordance with the provisions of AS2890.1 and 2 - 2004 for car parking and commercial vehicles respectively. **c** The design of the development driveway should take into consideration the traffic volumes of the surrounding road network. **d** Driveways should be: **i** Provided from lanes and secondary streets rather than the primary street, wherever practical; **ii** Located taking into account any services located within the road reserve, such as power poles, drainage inlet pits and existing street trees; **iii** Setback a minimum of 6m from the perpendicular of any intersection of any two roads; and **iv** Located to minimise noise and amenity impacts on adjacent residential development. **e** The driveway crossing and access roads shall be designed in accordance with the provisions of AS2890.1 and 2 - 2004 for car parking and commercial vehicles respectively. **f** Driveway widths must comply with the relevant Australian Standards. **g** Driveway grades, vehicular ramp width/grades and passing bays must be in accordance with the relevant Australian Standard (AS2890.1). **h** Access to basement parking shall have an entry threshold a minimum of 300mm above the top of the kerb. The threshold shall be increased within areas of flooding or local overland flows to a minimum of 300mm above the flood level. The design of the development shall ensure that floodwater cannot enter the car park in a 1% Annual Exceedance Probability (AEP) flood event. **i** The required threshold should be set within the property to prevent cross fall greater than 4% within the footway area. **j** No direct access will be permitted to the M4 Western Motorway.	Complies Access driveways would be designed in accordance with the relevant guidelines.

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
C10 Transport Access and Parking 10.5.2 Access and Driveways B. 3) Construction standards	**a** Roads shall be constructed to Council's standards in consultation with Council's Engineering Services Unit and Council's 'Guidelines for Engineering Works - Development and Subdivision'. **b** Design drawings should be accompanied by details of the erosion and sediment control measures that are to be implemented during construction.	Complies The road has been designed in accordance with the Guidelines for Engineering Works – Development and Subdivision and will be accompanied by an ESCP.
C10 Transport Access and Parking 10.5.2 Access and Driveways B. 6) Responding to topography	**a** Natural contours should be followed when designing and constructing driveways. Driveways should be located to retain as much of the property's vegetation as practicable. **b** Any new private access roads or driveways that connect to a public road should be sealed with asphalt or another suitable surface from the public road to prevent erosion and minimise dust and dirt transfer.	Complies The driveways have been designed to maintain vegetation where possible and to have a sealed surface.
C10 Transport Access and Parking 10.6 Pedestrian Connections B. Controls	**1** Footpaths should have ramps at all kerb corners for wheelchairs and pram access and cater for all people with diverse abilities in line with current Australian Standards. **2** Street lighting in accordance with the provisions of AS1158 should be present in all urban streets, while on rural traffic routes in general only intersections will be lit. Refer to Section C8 'Public Domain, for further information about lighting. **3** Pedestrian crossing distances in local streets should be shortened through kerb extensions and tight turning radii, which can cause vehicular traffic to slow to negotiate the tighter corners. **4** To enable comfortable passage for all people with diverse abilities, footpaths must be: **i** Provided on both sides of the road in urban areas; **ii** A minimum of 1.5m wide along collector and all lower order streets; and **iii** A minimum of 2.5m on approach routes to predictable destinations such as schools, parks and shopping precincts. (Three metre paths or wider are preferred). **5** Where street trees are not required to provide protection from passing cars for people on footpaths, a minimum outer nature strip of 0.5m on both sides of the street should be provided. Kerbs should be 'barrier' not 'rollover' design.	Complies Pedestrian connections would be designed in accordance with the relevant guidelines.

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SECTION IN DCP	REQUIREMENT	COMPLIANCE ASSESSMENT
	6 A durable, non-slip surface and even paving is to be designed and constructed for minimum maintenance. Continuous pathways, uninterrupted by variations in surface material must be provided. **7** Gradients from pathways to streets are to be minimal, safe and comfortable for people with limited mobility and those using wheelchairs, prams and trolleys in line with current Australian Standards. **8** Gradients and ramps must be aligned with desired paths of travel for pedestrians and cyclists. **9** A smooth transition from ramps to roads is to be provided for people using wheelchairs or prams. Ramps should be designed in accordance with appropriate design guidelines and be as wide as the pathway or marked crossing point to eliminate squeeze points at transition areas. **10** Reconstructed driveways/pathways are to achieve a useable cross slope for a width of 915mm. Cars must slow to negotiate the two steeper ramps on either side of the pathway crossing, but will not 'bottom out' at these angles. (Source: Preiser. W and Ostroff E (2001) Universal Design Handbook McGraw-Hill).	
C10 Transport Access and Parking 10.7 Bicycle Facilities B.1. Cycleways	**a** The minimum width of off-street shared cycle and pedestrian pathways is to be 2.5m on local routes with a minimum of 3m on major connector routes. **d** Shared paths and pedestrian refuge islands are to be designed to be fully accessible by all in terms of access points and gradients, in accordance with Australian Standard 1428:1-4	Complies The Proposal includes construction of a 2.5 metre off-street shared cycle and pedestrian pathway.
13.4 Engineering Works and Construction Standards C. Controls	All engineering works shall be undertaken in accordance with the provisions of Council's: — Stormwater Drainage Specifications for Building Developments — Council's Water Sensitive Urban Design (WSUD) Technical Guidelines; — Engineering Design Specifications for Civil Works; and — Engineering Construction Specifications for Civil Works.	Complies The Proposal has been designed in accordance with Council's guidelines and specifications for engineering works and construction standards.

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APPENDIX B

BIODIVERSITY ASSESSMENT REPORT

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LENDLEASE COMMUNITIES

NOVEMBER 2018

Links Road Extension

Biodiversity Assessment Report



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Links Road Extension
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Lendlease Communities

WSP
Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001

Tel: +61 2 9272 5100
Fax: +61 2 9272 5101
wsp.com

REV	DATE	DETAILS
A	16/11/2018	Final

	NAME	DATE	SIGNATURE
Prepared by:	Julia Wyllie; Troy Jennings	16/11/2018	
Reviewed by:	Mark Stables	16/11/2018	
Approved by:	Mark Stables	16/11/2018	

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GLOSSARY

BC Act	NSW *Biodiversity Conservation Act 2016*
Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: — Genetic diversity – the variety of genes (or units of heredity) in any population. — Species diversity – the variety of species. — Ecosystem diversity – the variety of communities or ecosystems.
Candidate species	Species considered likely to occur within the study area based on the presence of suitable habitat and outcome of likelihood of occurrence assessment.
Critical Habitat	The whole or any part or parts of an area or areas of land comprising the habitat of an endangered species, an endangered population or an endangered ecological community that is critical to the survival of the species, population or ecological community (Department of Environment and Conservation 2004). Critical habitat is listed under both the Threatened Species Conservation Act 1995 and the Environment Protection and Biodiversity Conservation Act 1999 and both the State (OEH) and Federal (DoEE) environment agencies maintain a register of this habitat. Capitalisation of the term 'Critical Habitat' in this report refers to the habitat listed specifically under the relevant State and Commonwealth legislation.
Department of the Environment and Energy (DoEE)	This Commonwealth Department develops and implements national policy, programs and legislation to protect and conserve Australia's natural environment and cultural heritage and administers the Environment Protection and Biodiversity Conservation Act 1999.
Department of Environment, Climate Change and Water (DECCW)	Former name for the NSW Office of Environment and Heritage (OEH).
Department of Sustainability, Environment, Water, Population and Communities (SEWPAC)	Former name for the Commonwealth Department of the Environment and Energy (2010–2013).
Department of the Environment, Water, Heritage and the Arts (DEWHA)	Former name of the Commonwealth Department of the Environment and Energy.
Direct impact	Where a primary action is a substantial cause of a secondary event or circumstance which has an impact on a protected matter (Commonwealth of Australia 2012).
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
Ecological community	An assemblage of species occupying a specific area.
FM Act	NSW *Fisheries Management Act 1994*
Ha	Hectare
Habitat	An area or areas occupied, or periodically or occasionally occupied by a species, population or ecological community, including any biotic or abiotic components.

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Indirect impact	An indirect impact is not a direct result of the Proposal or action, often produced away from or as a result of a complex impact pathway.
Key Threatening Processes	A process that threatens, or could threaten, the survival, abundance or evolutionary development of native species, populations or ecological communities (Department of Environment and Conservation 2004). Key Threatening Processes are listed under the Threatened Species Conservation Act 1995, the Fisheries Management Act 1994 and the Environment Protection and Biodiversity Conservation Act 1999. Capitalisation of the term 'Key Threatening Processes' in this report refers to those processes listed specifically under the relevant state and Commonwealth legislation.
Likely	Taken to be a real chance or possibility (Department of Environment and Conservation 2004).
Locality	The area within 10 km of the study area.
Local population	The population that occurs in the study area, unless the existence of adjoining or close-by occupied habitat and the movement of individuals or exchange of genetic material across the boundary can be demonstrated (Department of Environment and Climate Change 2007).
Matters of National Environmental Significance (MNES)	Matters of national environmental significance are matters which are protected under the Environment Protection and Biodiversity Conservation Act 1999 and include: world heritage properties; national heritage properties; wetlands of international importance; listed threatened species and communities; migratory species; Commonwealth marine areas.
Migratory species	Species protected as Migratory under the Environment Protection and Biodiversity Conservation Act 1999. Listed migratory species are those listed in the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA) and Republic of Korea – Australia Migratory Bird Agreement (RoKAMBA). Listed migratory species also include any native species identified in an international agreement approved by the Minister (Matthei 1995). Capitalisation of the term 'Migratory' in this report refers to those species listed as Migratory under the Environment Protection and Biodiversity Conservation Act 1999.
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (Department of Environment and Climate Change 2002).
Mitigation	Action to reduce the severity of an impact. (OEH 2014).
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.

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Office of Environment and Heritage (OEH)	Following the 2010 NSW elections the NSW Department of Environment Climate Change and Water (DECCW) was abolished and is now known as the Office of Environment and Heritage. It has been incorporated into the Department of Premier and Cabinet. Broadly, the Office of Environment and Heritage work towards a healthy environment cared for and enjoyed by the whole NSW community: manages the state's natural resources, including biodiversity, soils and natural vegetation: manages natural and cultural heritage across the state's land and waters: acts to minimise the impact of climate change: promotes sustainable consumption, resource use and waste management: regulates activities to protect the environment: and conducts biodiversity, plant, environmental and cultural heritage research to improve decision making.
Plant Community Type (PCT)	Plant community types (PCT) and their relationship to a vegetation formation and vegetation class is managed and maintained in the Vegetation Information System (VIS) Classification database. PCTs were developed as an unambiguous master community-level classification and consolidated two existing vegetation classifications – the NSW Vegetation Classification and Assessment database & the Biometric Vegetation Types database (Office of Environment and Heritage 2017).
Proposal	The upgrade and extension of Links Road to connect with Christie Street within St Marys, NSW
Proposal Footprint	The extent of the land that would be directly used for the construction and operation of the Proposal. It encompasses that land directly impacted by the new road infrastructure as well as the land that may be used by contractors for construction equipment, construction compound locations and laydown areas.
Protected species	Those species defined as protected under the National Parks and Wildlife Act 1974. Includes all native animals, and all native plants listed on Schedule 13 of the National Parks and Wildlife Act 1974.
REF	Review of Environment Factors
Region	A bioregion defined in a national system of bioregionalisation. For this study, this is the Sydney Basin Bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway and Cresswell 1995).
Significant	Important, weighty, or more than ordinary (as defined by the Department of Environment and Climate Change 2007).
Species Profile and Threats Database (SPRAT)	A government managed database to provide information about species and ecological communities listed under the Environment Protection and Biodiversity Conservation Act 1999.
Study area	The extent of the land that was subject to field survey.
Targeted species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.
Threatened biodiversity	Threatened species, populations or ecological communities, or their habitats as listed under the *Biodiversity Conservation Act 2016*, *Fisheries Management Act 1994* or the *Environment Protection and Biodiversity Conservation Act 1999*.

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Threatened species, populations and ecological communities	Species, populations and ecological communities listed as Vulnerable, endangered or critically endangered (collectively referred to as Threatened) under the Threatened Species Conservation Act 1995, Fisheries Management Act 1994 or the Environment Protection and Biodiversity Conservation Act 1999. Capitalisation of the terms 'threatened', 'vulnerable', 'endangered' or 'critically endangered' in this report refers to listing under the relevant state and/or Commonwealth legislation.
Viable local population	A population that has the capacity to live, develop, and reproduce under normal conditions, unless the contrary can be conclusively demonstrated through analysis of records and references (Department of Environment and Climate Change 2007).
Weed	Any plant that is not native to a local area and that has invaded native vegetation.

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1 INTRODUCTION

1.1 PROPOSAL BACKGROUND

Lendlease Communities are proposing to construct an upgrade and extension of Links Road to connect with Christie Street within St Marys, NSW (the Proposal). Links Road is a local road that currently serves the existing Dunheved Industrial Area and is within the Penrith Local Government Area (LGA).

The Proposal is located within St Marys, which is approximately 5 kilometres north-east of Penrith and 45 kilometres west of Sydney CBD. The Proposal would extend from the frontage of the South Dunheved Precinct (within the St Marys Development Site), along the existing north-south section of Links Road connecting to Christie Street near the Lee Holm Road intersection. It would provide an additional access point to the St Marys Development Site from the south via Christie Street.

The St Marys Development Site covers an area of approximately 1,545 hectares and comprises five precincts including (refer to Figure 1.1):

- Jordan Springs (formerly known as Western Precinct) and Jordan Springs East (formally known as Central Precinct) precincts, which include residential and recreational open space area
- Ropes Crossing (formerly known as Eastern Precinct and Ropes Creek Precinct)
- North Dunheved and South Dunheved precincts, which are zoned for Employment and are located immediately north of the existing Dunheved employment area.

The Precincts are development areas identified under the Sydney Regional Environmental Plan No. 30 – St Marys (SREP 30) that are being constructed by Lendlease.



Figure 1.1 St Marys development site

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1.2 PROPOSAL DESCRIPTION

The aim of this road extension is to provide an additional access to the St Marys Development Site from Christie Street.

The key components of the Proposal are:

- upgrading the existing Links Road from Dunheved Precinct to Dunheved Golf Club
- extending Links Road to Christie Street
- construction of a new four-way intersection at Christie Street and Lee Holm Road
- utility works and drainage upgrades
- provision of supporting roadside infrastructure including street lighting and signage.

The Proposal footprint is defined as the extent of the land that would be directly used for the construction and operation of the Proposal. It encompasses that land directly impacted by the new road infrastructure as well as the land that may be used by contractors for construction equipment, construction compound locations and laydown areas. This area is shown in Figure 1.2.

1.3 LEGISLATIVE CONTEXT

This Biodiversity Assessment Report has been prepared to support a development application with Penrith City Council. Penrith LGA is classified as an interim designated area under Part 7 Reg 27 of the Biodiversity Conservation (Savings and Transitional) Regulation 2017 and as such former planning provisions continue to apply to pending or interim planning applications that are submitted before 24 November 2018. Given this, significance assessments have been conducted on *Biodiversity Conservation Act 2016* entities in accordance with the former Section 5A of the *Environmental Planning and Assessment Act 1979* (Appendix E).

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Map: PS111235_GIS_001_A2	Author: David.Naiken		0 250 500 m 1:20,000
Date: 15/11/2018	Approved by: Julia.Wyllie		*Coordinate system: GCS GDA 1994* Scale ratio correct when printed at A3

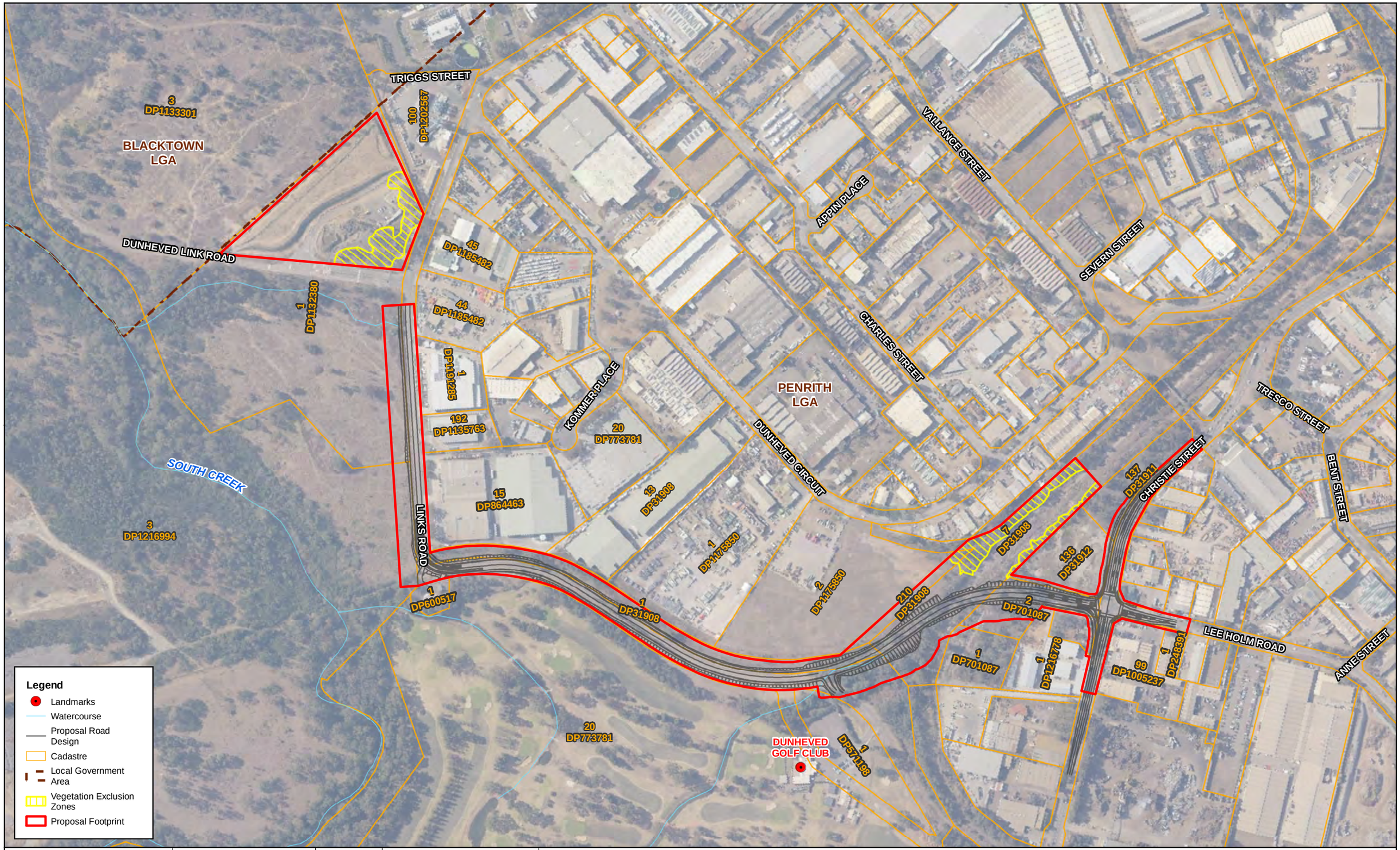
Data Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

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Links Road Extension: Biodiversity Assessment Report

Figure 1.2
Locality Map

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Map: PS111235_GIS_009_A3	Author: David.Naiken		0 50 100 m 1:5,000
Date: 15/11/2018	Approved by: Zoe.McLaughlin		*Coordinate system: GDA 1994 MGA Zone 56* Scale ratio correct when printed at A3

Data Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

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Links Road Extension - Statement of Environmental Effects

Figure 1.3
The Proposal

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2 METHODOLOGY

2.1 DEFINITIONS

For this report the following definitions apply:

- The Proposal is defined as the upgrade and extension of Links Road to connect with Christie Street within St Marys, NSW (Figure 1.1).
- The Proposal footprint is defined as the extent of the land that would be directly used for the construction and operation of the Proposal. It encompasses that land directly impacted by the new road infrastructure as well as the land that may be used by contractors for construction equipment, construction compound locations and laydown areas.
- Study area is defined as the area subject to detailed field survey and investigation.
- Locality refers to the area within 10 km of the study area.

2.2 PERSONNEL

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

Table 2.1 Contributors and their qualifications

NAME	QUALIFICATIONS	ROLE
Mark Stables	Bachelor of Science (Hons)	Principal Ecologist – Field Surveys/Technical Review
Tanya Bangel	Bachelor of Science (Hons); Diploma of Conservation and Land Management	Senior Ecologist – Field Surveys/Technical Review
Troy Jennings	Bachelor of Biodiversity and Conservation; Master of Wildlife Management	Ecologist – Field Surveys/Reporting
Julia Wyllie	Bachelor of Environment; Certificate 3 Conservation and Land Management	Ecologist – Field Surveys/Reporting
David Naiken	Bachelor of Environmental Science (GIS Major); Master in Climate Change	Senior GIS Consultant – Mapping and data management

2.3 NOMENCLATURE

Names of vegetation communities used in this report are based on the Plant Community Type (PCT) used in the NSW BioNet Vegetation Classification Database (Office of Environment & Heritage 2018).

These names are cross-referenced with those used for threatened ecological communities listed under the BC Act and/or the EPBC Act.

Names of plants used in this document follow PlantNET (Royal Botanic Gardens 2018). Scientific names are used in this report for species of plant. Scientific and common names (where available) are provided in the species results provided in Appendix C. The names of introduced species are denoted with an asterisk (*).

For threatened species of plants, the names used in the OEH Threatened Species Website (Office of Environment & Heritage 2018) are also provided in Appendix A where these differ from the names used in the PlantNET database.

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Names of vertebrate fauna follow the Australian Faunal Directory maintained by the Department of the Environment and Energy (Department of Environment and Energy, 2018). Common names are used in the report for species of animal.

For threatened species of animals, the names used in the OEH Threatened Species Website and NSW Department Primary Industries (Office of Environment and Heritage, 2018, Department of Primary Industries, 2017).

2.4 DESKTOP ASSESSMENT

A desk-based assessment was conducted to identify:

- the likely distribution of vegetation communities, based on previous mapping and aerial photograph interpretation, to allow for targeted field verification
- a list of candidate threatened species and populations of plants to consider during vegetation surveys and habitat assessment
- a list of candidate threatened species and populations of animals and migratory animals to consider during field-based habitat assessment
- local landscape-scale features of potential significance to biodiversity; e.g. riparian zones and potential wildlife movement corridors
- evaluate baseline information and determine whether additional surveys, mapping and reporting is required.

The desk-based assessment included analysis of the following information sources:

- topographic map and aerial photographs
- priority weed listings for the Greater Sydney region (Department of Primary Industries 2018)
- previous vegetation mapping, ecological studies and other relevant studies of the study area and surrounds:
  - St Marys Property – Western Precinct Biodiversity Assessment (Cumberland Ecology 2009)
  - Native vegetation of the Southeast NSW: Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al. 2010).

Records of threatened species, populations and ecological communities known or predicted to occur in the locality of the study area were obtained from a range of databases as detailed in Table 2.2.

Table 2.2 Database searches undertaken

DATABASE	SEARCH DATE	AREA SEARCHED	REFERENCE
Bionet Atlas of NSW Wildlife	09/10/2018	10 km buffer around the study area	Office of Environment and Heritage (2018)
Protected Matters Search Tool	09/10/2018	10 km buffer around the study area	Department of the Environment and Energy (2018)
PlantNet	09/10/2018	LGA spatial search	Royal Botanic Gardens Sydney (2018)

Other relevant documents and data that were reviewed as part of this study are referenced throughout this report where appropriate.

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2.5 FLORA SURVEYS

Threatened flora surveys were undertaken over a four-day period on 15 August, 12 and 17 September and 10 October, 2018. Surveys focused on the mapping of native and non-native vegetation types and targeting the possible presence of threatened flora species using a combination of vegetation integrity plots, random meanders and parallel field traverses generally in accordance with the NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (Department of Environment and Conservation 2004), NSW Guide to Surveying Threatened Plants (Office of Environment & Heritage 2016) and the BAM (Office of Environment & Heritage 2017). A detailed overview of terrestrial flora survey methods is presented below.

2.5.1 STRATIFICATION AND VERIFICATION OF EXISTING VEGETATION MAPPING

Preliminary mapping of vegetation community boundaries was undertaken through analysis of existing vegetation mapping and aerial photograph interpretation.

Analysis of the aerial photographs was used to identify areas of disturbance (e.g. buildings, vehicle tracks, dams and power lines), vegetation structure and likely native versus exotic species composition throughout the site. This provided an initial definition of vegetation communities into simple structural and disturbance classifications for verification during field surveys.

Vegetation within the study area and locality has been mapped at the regional scale in:

— Native vegetation of the Southeast NSW: Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al. 2010).

Data on geology, dominant canopy species, native species richness, vegetation structure and condition was collected across the study area to validate and refine this existing vegetation classification to determine their associated Plant Community Type (PCT) in accordance with the BioNet Vegetation Classification System (Office of Environment & Heritage, 2018).

2.5.2 MAPPING OF VEGETATION ZONES

The vegetation within the study area was firstly assessed to a PCT level and then aligned to a vegetation zone which is defined as ‘an area of native vegetation on the subject land that is the same PCT and has a similar broad condition state’ (Office of Environment & Heritage, 2017). A broad condition state infers that the vegetation has a similar tree cover, shrub cover, ground cover, weediness or combinations of these attributes which determine vegetation condition.

The vegetation broad condition states which were applied to determine vegetation zones within the study area are summarised in Table 2.3. These factors were defined by using features such as levels of disturbance, weed invasion and resilience.

Table 2.3 Vegetation broad condition states

CONDITION CATEGORY	DESCRIPTION
Good	Vegetation still retains the species complement and structural characteristics. The vegetation displays resilience to weed invasion due to intact groundcover, shrub and canopy layers. Native species diversity is relatively high. Weeds may exist in this vegetation type but exhibit <10% foliage cover.
Moderate	Vegetation has retained a native canopy but the understorey and groundcover layers are generally co-dominated by exotic species that exhibit between 10–<40% foliage cover. The mid and low stratums may have been structurally modified because of previous clearing.

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CONDITION CATEGORY	DESCRIPTION
Poor	Vegetation has retained a native canopy or the canopy cover is showing signs of regeneration. The understorey and groundcover layers are generally dominated or co-dominated by exotic species that exhibit between >40% foliage cover or exhibit low native species richness (<25% PCT benchmark). Native species diversity is generally relatively low and the mid and low stratums have been structurally modified due to weed incursions or clearing.
Low	Native vegetation generally lacking a native over-storey and where either less than 50% of ground cover vegetation is indigenous species, or greater than 90% of ground cover vegetation is cleared.

2.5.3 VEGETATION INTEGRITY PLOTS

A total of five vegetation integrity plots were completed as outlined in the BAM and as described below. A schematic diagram illustrating the layout of each vegetation integrity plot is provided in Figure 2.1.

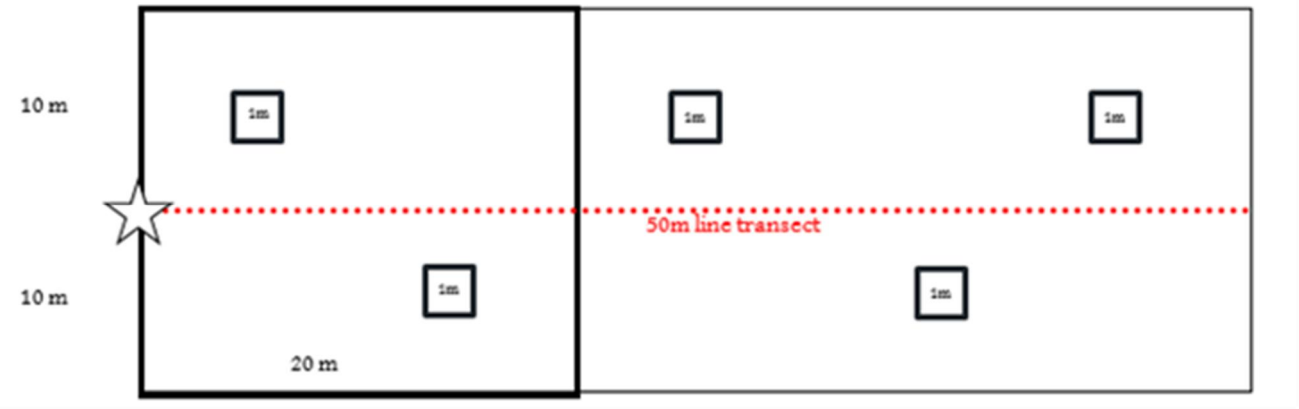


Figure 2.1 Schematic diagram illustrating the layout of the nested 20 m x 20 m and 20 m x 50 m plot used for the assessment of vegetation integrity at each plot location

The following site attributes were recorded at each vegetation integrity plot location:

Location (easting – northing grid type MGA 94, Zone 56)

- Vegetation structure and dominant species and vegetation condition. Vegetation structure was recorded through estimates of percentage foliage cover, average height and height range for each vegetation layer.
- Native and exotic species richness (within a 400 m^2 quadrat): This consisted of recording all species by systematically walking through each 20 m x 20 m quadrat. The cover and abundance (percentage of area of quadrat covered) of each species was estimated. The growth form, stratum/layer and whether each species was native/exotic/high threat weed was also recorded.
- Number of trees with hollows (1,000 m^2 quadrat): This was the frequency of hollows within living and dead trees within each 50 m x 20 m quadrat. A hollow was only recorded if (a) the entrance could be seen: (b) the estimated entrance width was at least 5 cm across: (c) the hollow appeared to have depth: (d) the hollow was at least 1 m above the ground and the (e) the centre of the tree was located within the sampled quadrat.
- Number of large trees and stem size diversity (1,000 m^2 quadrat): tree stem size diversity was calculated by measuring the diameter at breast height (DBH) (i.e. 1.3 m from the ground) of all living trees (>5 cm DBH) within each 50 x 20 m quadrat. For multi-stemmed living trees, only the largest stem was included in the count. Number of large trees was determined by comparing living tree stem DBH against the PCTs benchmarks.
- Total length of fallen logs (1,000 m^2 quadrat): This was the cumulative total of logs within each 50 m x 20 m quadrat with a diameter of at least 10 cm and a length of at least 0.5 m.

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— Litter cover: This comprised estimating the average percentage groundcover of litter (i.e. leaves, seeds, twigs, branchlets and branches with a diameter <10 cm which is detached from a living plant) from within five 1 m x 1 m sub-plots spaced evenly either side of the 50 m central transect.

— Evaluation of regeneration: This was estimated as the presence/absence of overstorey species present at the site that was regenerating (i.e. saplings with a diameter at breast height ≤5 cm).

Prior to establishing plot survey locations, vegetation stratification was undertaken to provide a representative vegetation zone for sampling. Stratification involved marking waypoints and bearings randomly to provide a representative assessment of the vegetation integrity of the vegetation zone in the study area and establishing the required number of plots at some of these waypoints.

A comparison of the number of BAM survey plots that were completed and the required BAM plots per vegetation zones are outlined in Table 2.4.

Table 2.4 Comparison of number of plots required under BAM and completed per vegetation zone

VEGETATION TYPE AND ZONE	PROPOSAL FOOTPRINT (ha)	BAM PLOT REQUIRED	NUMBER OF PLOTS COMPLETED
PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (Moderate Condition)	1.91	1	4 (Q3, Q4, Q5, Q6)
PCT 724 Broad-leaved Ironbark – Grey Box -Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion (Moderate Condition)	0.90	1	1 (Q1)
PCT 724 Broad-leaved Ironbark – Grey Box -Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion (Low Condition)	0.49	1	1 (Q11)
PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (Moderate Condition)	0.55	1	1 (Q10)
Miscellaneous Ecosystem (Urban Exotic/Native Landscape Plantings)	0.12	0	–
Miscellaneous Ecosystem (Highly disturbed areas with no or limited native vegetation)	5.86	0	1 (Q9)

2.5.4 RANDOM MEANDER SURVEY

Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (1993), whereby the recorder walks in a random meander throughout the study area recording dominant and key plant species (e.g. threatened species, priority weeds), boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness.

Random meander surveys were conducted to locate candidate threatened species and populations within area of suitable habitat. Where a threatened flora species was located, parallel field traverses were then conducted to determine the size and extent of the population.

At each vegetation integrity plot a 30-minute targeted threatened flora search was also conducted for each candidate species that were considered to have potential habitat in the sampled vegetation type.

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2.5.5 PARALLEL FIELD TRAVERSES

Parallel field traverses followed methods outlined in the NSW Guide to Surveying Threatened Plants (Office of Environment & Heritage 2016). Parallel field traverses involved two people walking a fixed bearing transect at 10 metre intervals over known or high likelihood potential habitat for candidate threatened flora species.

2.5.6 THREATENED FLORA LIKELIHOOD OF OCCURRENCE ASSESSMENT

Threatened flora species and populations subject to likelihood of occurrence assessments were those identified during the background research, BAM calculator candidate and predicted species lists and any additional species considered having the potential to occur in the professional opinion of contributors to this assessment.

The likelihood of occurrence assessment was utilised to produce a candidate species list to inform appropriate targeted surveys. The assessment was based on the habitat profile for the species and other habitat information in the Threatened Species Profile Database (Office of Environment and Heritage 2017) and the Species Profile and Threats Database (Department of the Environment and Energy 2017).

The assessment also included consideration of the dates and locations of nearby records and information about species distribution and populations in the locality along with key habitat requirements such as:

- associated native plant community types and taxa
- topographic, soil or geological preferences
- microhabitats (e.g. Preference for rocky outcrops, ground soaks or tree canopies)
- disturbances, such as fire history, and the level and type of disturbance (e.g. slashing, canopy removal).

For this study, the likelihood of occurrence of threatened flora species and populations was determined based on the criteria outlined in Table 2.5.

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Table 2.5 Likelihood of occurrence criteria for terrestrial threatened flora species and populations

LIKELIHOOD	CRITERIA
Known	The species was observed in the study area either during the current survey or during another survey less than 5 years prior; assuming no significant change in conditions on site (e.g. vegetation clearing, fire).
High	A species has a high likelihood of occurrence if: — the study area contains or forms part of a large area (> 1 ha) of high quality suitable habitat that has not been subject to recent disturbance (e.g. fire), the species is known to form a persistent soil seedbank and the species has been recorded recently (within 10 years) in the locality — the species is a cryptic flowering species that has been recorded recently (within 10 years) in the locality and has a large area (> 1 ha) of high quality potential habitat on site that was not seasonally targeted by surveys.
Moderate	A species has a moderate likelihood of occurrence if: The species: — has a large area (> 1 ha) of high quality suitable habitat in the study area that has not been subject to recent disturbance (e.g. fire), and — the species is known to form a persistent soil seedbank, but — the species has not been recorded recently (within 10 years) in the locality. The species: — has a small area (< 1 ha) of high quality suitable habitat or a large area (> 1 ha) of marginal habitat in the study area that has not been subject to recent disturbance (e.g. fire), and — the species is known to form a persistent soil seedbank, and — the species has been recorded recently (within 10 years) in the locality — the species is a cryptic flowering species, with a small area of high quality potential habitat (< 1 ha) or a large area of marginal habitat on site (> 1 ha), that was not seasonally targeted by surveys.
Low	A species has a low likelihood of occurrence if: — the species' potential habitat is of high quality but is small in area (< 1 ha) and it is not a cryptic species nor a species known to have a persistent soil seedbank or — the species' potential habitat is marginal and the species has not been recorded in the locality.
None	Potentially suitable habitat is absent from the study area.

2.6 FAUNA SURVEYS

This section outlines the fauna survey effort completed for candidate species which were predicted to have a moderate to high likelihood of occurrence within the study area based on database searches outlined in section 2.4. Threatened fauna surveys completed within the study area were carried out as described below and where applicable, considering the methodology detailed in the NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (Department of Environment and Conservation 2004). Fauna surveys were limited to fauna habitat assessments, opportunistic sightings, diurnal bird surveys and active invertebrate searches.

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2.6.1 FAUNA HABITAT ASSESSMENT

Fauna habitat assessments were undertaken to assess the likelihood of threatened species of animal (those species known or predicted to occur within the locality from the literature and database review) occurring within the study area. Fauna habitat assessments were the primary assessment tool in assessing whether threatened species were likely to occur within the study area. Fauna habitat characteristics assessed included:

- structure and floristics of the canopy, understorey and ground vegetation, including the presence of flowering and fruiting trees providing potential foraging resources
- presence of hollow-bearing trees providing roosting and breeding habitat for arboreal mammals, birds and reptiles
- presence of the ground cover vegetation, leaf litter, rock outcrops and fallen timber and potential to provide protection for ground-dwelling mammals, reptiles and amphibians
- presence of waterways (ephemeral or permanent) and water bodies.

The following criteria were used to evaluate the condition of habitat values:

- **Good:** A full range of fauna habitat components are usually present (for example, old-growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
- **Moderate:** Some fauna habitat components are missing or greatly reduced (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
- **Poor:** Many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive clearing in the past.

2.6.2 OPPORTUNISTIC RECORDING OF FAUNA SPECIES AND EVIDENCE OF FAUNA ACTIVITY

Opportunistic sightings of animals were recorded during field surveys. Evidence of animal activity, such as scats, diggings, scratch marks, nests/dreys, burrows etc. were also noted. This provided indirect information on animal presence and activity.

During these surveys, a hand-held GPS was used to record the locations significant fauna habitat values such as large hollow-bearing trees, aquatic habitat and rock outcrops where observed.

2.6.3 DIURNAL BIRD SURVEYS

Formal 20-minute diurnal bird searches were completed within the study area. Bird surveys were completed by actively walking through the study area over a period of 20 minutes. All birds were identified to the species level, either through direct observation or identification of calls. Bird surveys were completed generally during morning hours. Birds were also recorded opportunistically during all other surveys.

Where seasonal conditions for some species were not suitable during the timing of onsite investigations, as was the case for endangered blossom nomads such as Swift Parrot, likelihood of occurrence assessments were conducted by the presence/absence of suitable habitat and its condition.

2.6.4 ACTIVE INVERTEBRATE SEARCHES

Active invertebrate searches involve diurnal hand searches (i.e. disturbance of habitat) and visual searches targeting specific habitat. In relation to threatened invertebrate species (i.e. Cumberland Plain Land Snail) specific habitat preferences include under logs and other debris, amongst leaf litter and bark accumulations around bases of trees and sometimes in clumps of grass. Invertebrates are also known to shelter under rubbish, disposed building materials and abandoned car parts (National Parks and Wildlife Service 2000).

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2.6.5 FAUNA LIKELIHOOD OF OCCURRENCE ASSESSMENT

Threatened species identified in the desktop review were assessed for likelihood of occurrence based on results of the desk and field-based assessments. The likelihood of threatened species occurring within the study area was assessed against the criteria outlined in Table 2.6.

Table 2.6 Likelihood of occurrence assessment

LIKELIHOOD-OF-OCCURRENCE	CRITERIA
Low	Have not been recorded previously in the study area and surrounds which are beyond the current known geographic range. Are dependent on specific habitat types or resources that are not present in the study area. Are considered extinct in the locality.
Moderate	Have been recorded previously infrequently in the study area and surrounds (i.e. vagrant individuals). Use habitat types or resources that are present in the study area, although resources are generally in a poor or modified condition. Are unlikely to maintain sedentary populations, however may utilise resources within the study area opportunistically when resources seasonally available or during migration.
High	Have been previously recorded in the study area. Are dependent on habitat types or resources that are present in the study area that are abundant and/or in good condition within the study area. Are known or likely to maintain resident populations surrounding the study area. Are known or likely to visit the study area or surrounds during regular seasonal movements or migration.
Recorded	Recorded within the study area during the current or previous surveys.

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3 EXISTING ENVIRONMENT

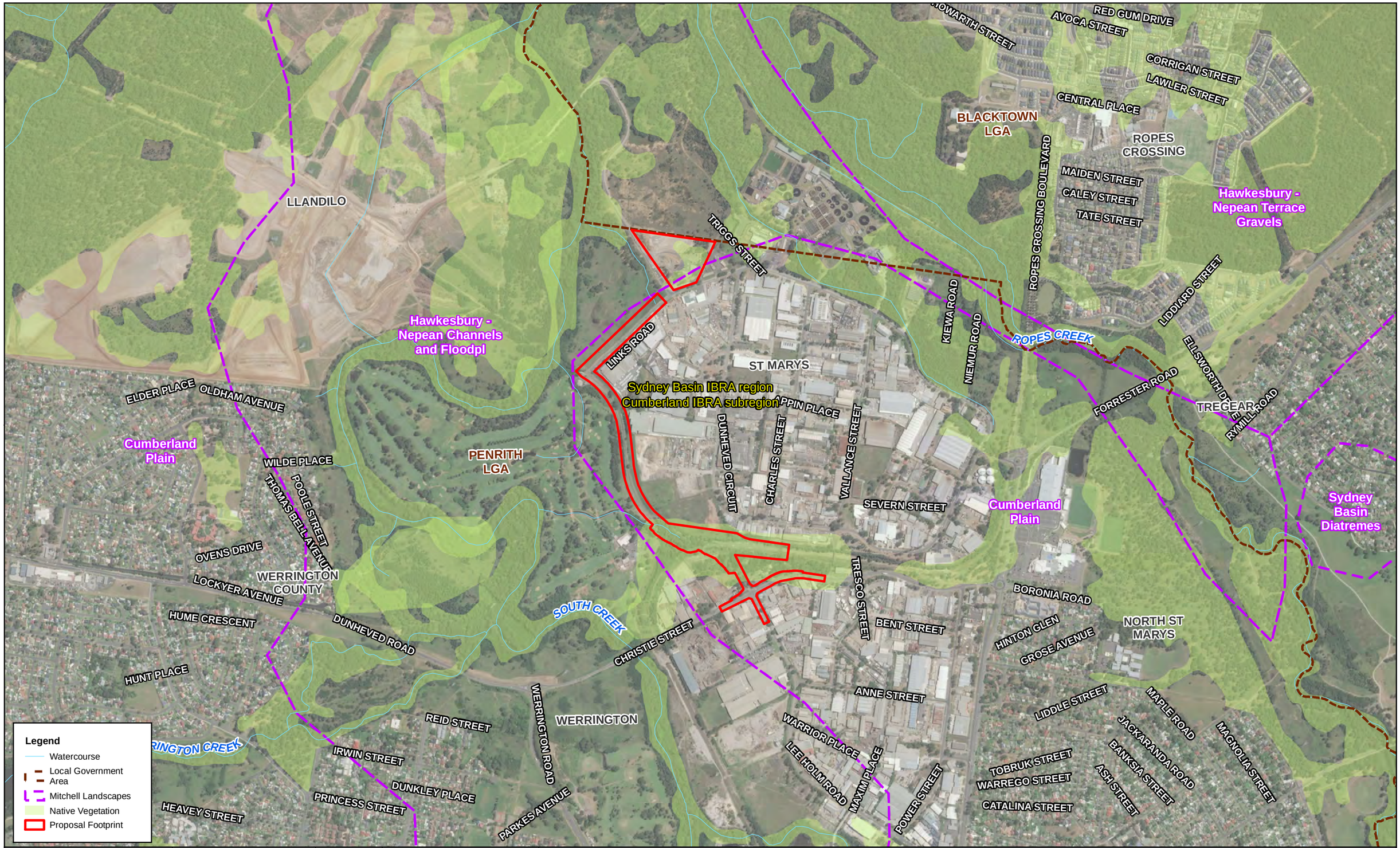
3.1 LANDSCAPE FEATURES

The study area is in the Sydney Basin IBRA bioregion and occurs within the SYB08 Cumberland IBRA subregion (IBRA version 7.0). Landscape features within the study area are summarised in Table 3.1 and shown in Figure 3.1.

Table 3.1 Landscape feature

LANDSCAPE FEATURE	STUDY AREA
IBRA bioregions and subregions	Sydney Basin Bioregion/SYB08 Cumberland subregion
NSW landscape regions (Mitchell landscapes)	Cumberland Plain/Hawkesbury-Nepean Channels and Floodplain
Local Government Area (LGA)	Penrith City Council
Rivers and streams	Ephemeral tribuaries of South Creek
Important and local wetlands	No impact to important or local wetland within the study area
Connectivity features	Connectivity is limited to the riparian areas of South Creek and its tribuaries
Areas of Geological Significance and Soil Hazard Features	No areas of Geological Significance and Soil Hazard features occur within the study area
Areas of outstanding biodiversity value	Mapped within northern section of the study area. This area has since been cleared.

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Map: PS111235_GIS_003_A2	Author: David.Naiken	0 200 400 m 1:12,500	**Links Road Extension: Biodiversity Assessment Report**
Date: 13/11/2018	Approved by: Julia.Wyllie	*Coordinate system: GDA 1994 MGA Zone 56* Scale ratio correct when printed at A3	**Figure 3.1** Landscape Features

Data Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

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3.2 VEGETATION

A total of three native vegetation PCTs were recorded in the study area. These are:

- PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion
- PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion.

In addition, two non-native vegetation types were assigned to a miscellaneous ecosystem class, being:

- Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation
- Miscellaneous ecosystem – urban exotic/native landscape plantings.

These three native and two non-native vegetation communities (listed above) were assigned to six discrete vegetation zones based on broad vegetation condition class criteria as outlined in Section 2.5.2. A summary of native vegetation PCTs and associated vegetation zones along with non-native vegetation types are presented in Table 3.2. The extent and distribution of each vegetation type and zone is shown in Figure 3.2.

Detailed description and selection justification for each native vegetation PCT and vegetation zone is provided Section 3.2.1. below. A summary and description of non-native vegetation types is presented in Section 3.2.2.

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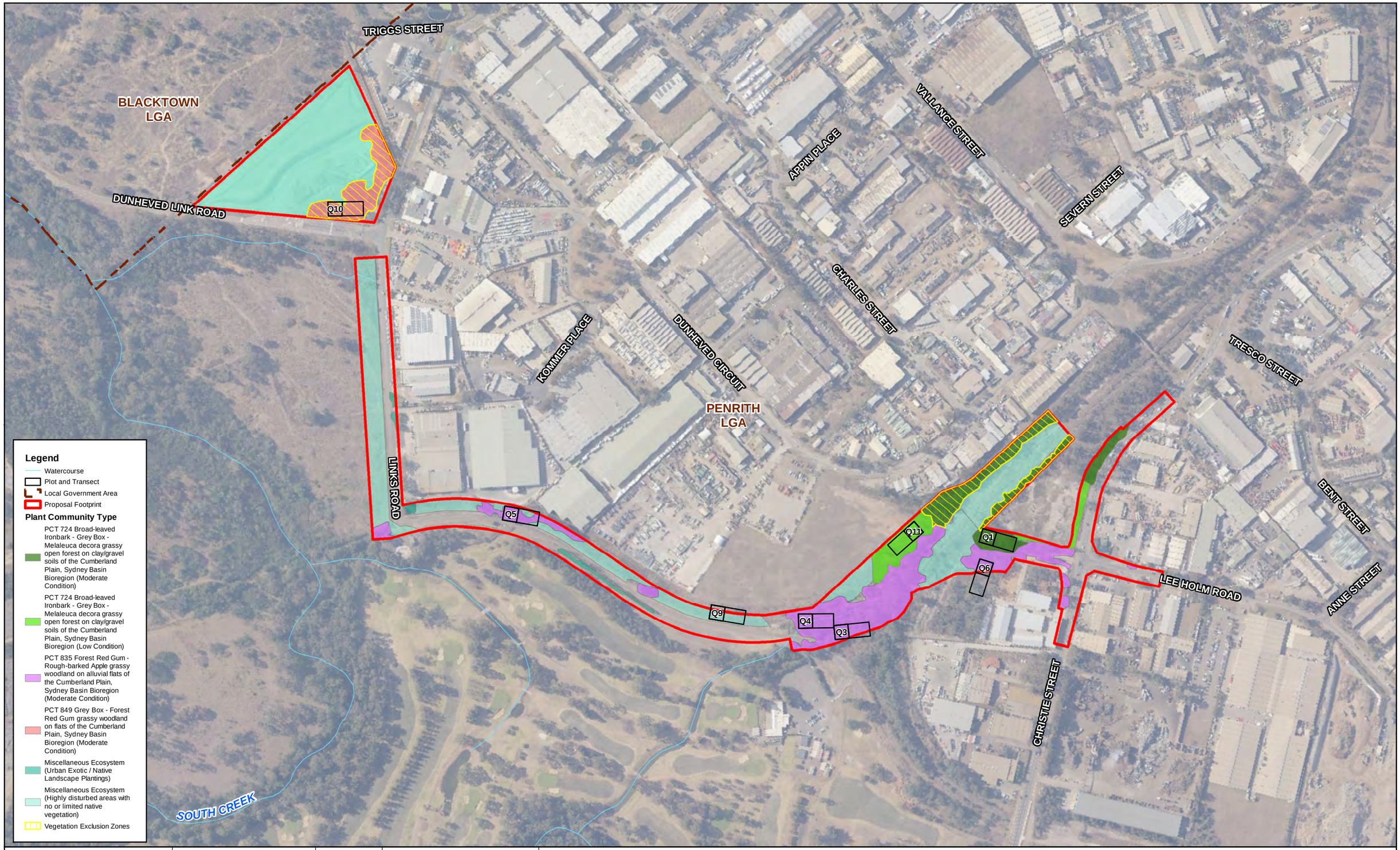
Table 3.2 Overview of native and non-native vegetation types and zones recorded within the study area

VEGETATION TYPE	VEGETATION ZONE	THREATENED ECOLOGICAL COMMUNITY	VEGETATION FORMATION	VEGETATION CLASS	IBRA REGION / SUBREGION	PCT% CLEARED	EXTENT IN PROPOSAL FOOTPRINT (ha)
Native vegetation							
PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	VZ1 – Moderate condition	Shale Gravel Transition Forest in the Sydney Basin Bioregion	KF_CH5A Dry Sclerophyll Forests (Shrubby/grass sub-formation)	Cumberland Dry Sclerophyll Forests	Sydney Basin Bioregion / SYB08 Cumberland subregion	75%	0.90
	VZ2 – Low condition						0.49
PCT 835 Forest Red Gum-Rough-barked Apple Grassy Woodland on Alluvial Flats of the Cumberland Plain, Sydney Basin	VZ3 – Moderate condition	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	KF_CH9 Forested Wetland	Coastal Floodplain Wetland	Sydney Basin Bioregion / SYB08 Cumberland subregion	93%	1.91
PCT 849 Grey Box-Forest Red Gum Grassy Woodland on Flats of the Cumberland Plain, Sydney Basin	VZ4 – Moderate condition	Cumberland Plain Woodland in the Sydney Basin Bioregion	KF_CH3 Grassy Woodlands	Coastal Valley Grassy Woodlands	Sydney Basin Bioregion / SYB08 Cumberland subregion	93%	0.55
Total native vegetation							**3.85**

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VEGETATION TYPE	VEGETATION ZONE	THREATENED ECOLOGICAL COMMUNITY	VEGETATION FORMATION	VEGETATION CLASS	IBRA REGION / SUBREGION	PCT% CLEARED	EXTENT IN PROPOSAL FOOTPRINT (ha)
Non-native vegetation							
Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation	VZ5	–	–	-	–	–	5.86
Miscellaneous ecosystem – urban exotic / native landscape plantings	VZ6	–	–	–	–	–	0.12
Total non-native vegetation							**5.98**

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Map: PS111235_GIS_004_A5	Author: David.Naiken		0 50 100 m 1:5,000
Date: 13/11/2018	Approved by: Julia.Wyllie		*Coordinate system: GDA 1994 MGA Zone 56* Scale ratio correct when printed at A3

Data Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

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Links Road Extension: Biodiversity Assessment Report

Figure 3.2
Vegetation Types and Zones

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3.2.1 NATIVE VEGETATION TYPES

A total of three native vegetation PCTs were recorded in the study area. These are:

- PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion
- PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion.

Detailed description of recorded attributes and selection justification for each native vegetation PCT and associated vegetation zone is provided below.

3.2.1.1 PCT 724 BROAD-LEAVED IRONBARK – GREY BOX – MELALEUCA DECORA GRASSY OPEN FOREST ON CLAY/GRAVEL SOILS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION

The occurrence of this vegetation type within the study area is illustrated in Figure 3.2 with photographic representation provided in Photo 3.1 – Photo 3.4. A profile of PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion is provided in Table 3.3 and a comparison of recorded vegetation integrity data against community condition benchmark data is presented in Table 3.4.

Table 3.3 Summary of recorded attributes for PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion

PCT 724 BROAD-LEAVED IRONBARK – GREY BOX – MELALEUCA DECORA GRASSY OPEN FOREST ON CLAY/GRAVEL SOILS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION	
PCT Justification	In assigning this vegetation type, the following three candidate PCTs were considered based on floristic similarities and given the communities are known to intergrade: — PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion — PCT 725 – Broad-leaved Ironbark – Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion — PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion. Based on the presence of *Eucalyptus fibrosa* (Red Ironbark), *Eucalyptus moluccana* (Grey Box) and *Melaleuca decora* (White Feather Myrtle) in the canopy, the occurrence of *Pultenaea parviflora* in the middle stratum and the presence of iron-indurated gravels derived from Tertiary alluvium this vegetation type was considered most representative of PCT 724.
Vegetation formation	KF_CH5A Dry Sclerophyll Forests (Shrubby/grass sub-formation)
Vegetation class	Cumberland Dry Sclerophyll Forests
Vegetation zone	VZ1 – moderate condition class VZ2 – poor condition class

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PCT 724 BROAD-LEAVED IRONBARK – GREY BOX – MELALEUCA DECORA GRASSY OPEN FOREST ON CLAY/GRAVEL SOILS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION	
Conservation status:	BC Act: Shale Gravel Transition Forest in the Sydney Basin Bioregion – Endangered ecological community EPBC Act: Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – Critically Endangered A total of three threatened flora species were also recorded within this vegetation type: — *Dillwynia tenuifolia* – Vulnerable (BC Act) — *Grevillea juniperina* subsp. *juniperina* (Juniper-leaved Grevillea) – Vulnerable (BC Act) — *Pultenaea parviflora* – Endangered (BC Act) and Vulnerable (EPBC Act).
Percent cleared	75%
Vegetation integrity plots	Q1, Q11
Landscape position	This vegetation type occurs on slightly elevated areas associated with tertiary alluvial gravels in the north-eastern portion of the study area.
Species upper stratum	The canopy is generally of a young age cohort due to previous clearing for rail infrastructure although scattered isolated semi-mater trees were observed more generally with vegetated areas to the west of Christie Street in the northern portion of the study area. Dominant trees include *Angophora floribunda* (Rough-barked Apple) particularly in transitional areas with PCT 835, *Eucalyptus fibrosa* (Red Ironbark), *Eucalyptus eugenioides* (Thin-leaved Stringybark) and *Eucalyptus moluccana* (Grey Box). Occasional mature specimens of *Melaleuca decora* (White Feather Myrtle) were also recorded.
Species middle stratum	Dominant species include; *Acacia falcata*, *Bursaria spinosa* subsp. *spinosa* (Native Blackthorn), *Lissanthe strigosa* (Peach Heath), *Grevillea juniperina* subsp. *juniperina* (Juniper-leaved Grevillea), *Dillwynia sieberi*, *Daviesia ulicifolia* (Gorse Bitter Pea).
Species ground stratum	*Aristida vagans* (Threeawn Speargrass), *Brunoniella australis* (Blue Trumpet), *Cheilanthes sieberi* subsp. *sieberi* (Mulga Fern), *Cymbopogon refractus* (Barbed Wire Grass), *Dichondra repens* (Kidney Weed), *Lomandra filiformis* subsp. *filiformis, Paspalidium distans.*
Vegetation condition	The vegetation type occurred in two condition classes, being moderate and poor. Moderate condition class contained a native canopy cover with relatively intact middle and ground stratum vegetation. This condition class has been subject to previous historic disturbances and ongoing weed incursions particularly from the perennial exotic grass *Eragrostis curvula** (African Love Grass). Low condition class was mostly recorded outside the study area and is associated with historical clearing and regenerating vegetation. This vegetation class lacks an upper stratum or canopy layer and is dominated by exotic weed species.
Extent within the Proposal footprint	Moderate condition = 0.90 ha Poor condition = 0.49 ha

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Photo 3.1 PCT 724 moderate condition to the east of the decommissioned Ropes Creek railway line



Photo 3.2 PCT 724 clay soils with extensive iron-indurated gravels derived from Tertiary alluvium



Photo 3.3 PCT 724 moderate condition near Christie Street



Photo 3.4 PCT 724 low condition adjacent to the Proposal footprint

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Table 3.4 Comparison of PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion vegetation integrity plot data against PCT condition benchmark data

PLOT	TREE RICHNESS	SHRUB RICHNESS	GRASS RICHNESS	FORB RICHNESS	FERN RICHNESS	OTHER RICHNESS	TREE COVER	SHRUB COVER	GRASS COVER	FORB COVER	FERN COVER	OTHER COVER	LENGTH TIMBER	LEAF LITTER	LARGE TREE
BM[1]	**6**	**12**	**13**	**12**	**2**	**5**	**44**	**40**	**47**	**6**	**1**	**3**	**68**	**60**	**3(50)**
Q1	4	8	13	4	0	5	38	28.6	14.5	1.5	0	0.6	37	52	1
Q11	4	4	4	1	1	0	5.1	2.6	3.5	0.1	0.1	0	0	3	0

(1) Benchmark data for equivalent community in NSW Sydney Basin IBRA Bioregion; Vegetation Type - PCT 724 Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion; Keith Formation: KF_CH5A Dry Sclerophyll Forests (Shrubby/grass sub-formation); Keith Class: Cumberland Dry Sclerophyll Forests; source NSW BioNet Vegetation Classification database accessed October 2018.

3.2.1.2 PCT 835 FOREST RED GUM - ROUGH-BARKED APPLE GRASSY WOODLAND ON ALLUVIAL FLATS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION

The occurrence of this vegetation type within the study area is illustrated in Figure 3.2 with photographic representation provided in Photo 3.5 to Photo 3.8. A profile of PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion is provided in Table 3.5 and a comparison of recorded vegetation integrity data against community condition benchmark data is presented in Table 3.6.

Table 3.5 Summary of recorded attributes for PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

PCT 835 FOREST RED GUM – ROUGH-BARKED APPLE GRASSY WOODLAND ON ALLUVIAL FLATS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION	
PCT Justification	In assigning this Plant Community Type the following communities were considered: — PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion — PCT 725 – Broad-leaved Ironbark – Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion — PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion — PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion. Due to the lack of species richness, floristic analysis which compared the presence of positive diagnostic species between candidate PCTs was inconclusive. A combination of landscape position, geological characteristics and dominant species were analysed. The canopy stratum is dominated by the three PCT 835 diagnostic species; *Angophora floribunda* (Rough-barked Apple), *Eucalyptus amplifolia* subsp. *amplifolia* (Cabbage Gum), *Eucalyptus tereticornis* (Forest Red Gum) and was recorded on alluvial flats associated with tributaries of South Creek. These had a slightly lower elevation that that of PCT 724 and PCT 849. Overall, though this vegetation has mostly been modified through clearing, earth-moving and weed invasion, it is considered consistent with the scientific description and distribution information outlined for PCT 835.
Vegetation formation	KF_CH9 Forested Wetland
Vegetation class	Coastal Floodplain Wetland
Vegetation zone	VZ3
Conservation status:	BC Act: River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – Endangered ecological community EPBC Act: Not listed Two threatened flora species were recorded within this vegetation type: — *Grevillea juniperina* subsp. *juniperina* (Juniper-leaved Grevillea) – Vulnerable (BC Act) — *Pultenaea parviflora* – Endangered (BC Act and EPBC Act).
Percent cleared	93%
Vegetation integrity plots	Q3, Q4, Q5, Q6

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PCT 835 FOREST RED GUM – ROUGH-BARKED APPLE GRASSY WOODLAND ON ALLUVIAL FLATS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION	
Landscape position	This vegetation type occurs on alluvial flats and low-lying areas associated with the South Creek floodplain and associated tributaries.
Species upper stratum	*Angophora floribunda* (Rough-barked Apple), *Eucalyptus amplifolia* subsp. *amplifolia* (Cabbage Gum), *Eucalyptus tereticornis* (Forest Red Gum) with scattered patches dominated by *Ligustrum lucidum** (Large-leaved Privet).
Species middle stratum	*Acacia falcata* (Hickory Wattle), *Acacia parramattensis* (Parramatta Wattle), *Bursaria spinosa* subsp. *spinosa* (Blackthorn), *Daviesia ulicifolia, Grevillea juniperina subsp. juniperina* (Juniper-leaved Grevillea).
Species ground stratum	*Aristida ramosa* (Purple Wiregrass), *Chloris gayana** (Rhodes Grass), *Cynodon dactylon* (Common Couch), *Eragrostis curvula** (African Love Grass), *Hardenbergia violacea* (False Sarsaparilla), *Microlaena stipoides var. stipoides* (Weeping Meadow Grass), *Paspalum dilatatum** (Paspalum), *Pavonia hastata**, *Rubus fruticosus* agg.* (Blackberry).
Vegetation condition	Vegetation was recorded entirely in Moderate condition class contained a native canopy cover with relatively intact middle and ground stratum vegetation. This condition class has been subject to previous historic disturbances and ongoing weed incursions from edge effects. The ground stratum was dominated by the perennial exotic grass *Eragrostis curvula** (African Love Grass).
Extent within the Proposal footprint	1.91 ha

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Photo 3.5 *Eucalyptus amplifolia* subsp. *amplifolia* (Cabbage Gum) juveniles with *Eragrostis curvula** (African Love Grass) understorey



Photo 3.6 *Angophora floribunda* (Rough-barked Apple) recorded on alluvial soils opposite Dunheved Golf Club



Photo 3.7 PCT 835 recorded parallel to a tributary of South Creek and Links Road



Photo 3.8 *Angophora floribunda* (Rough-barked Apple) canopy recorded in areas of slightly elevation

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Table 3.6 Comparison of PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion vegetation integrity plot data against PCT condition benchmark data

PLOT	TREE RICHNESS	SHRUB RICHNESS	GRASS RICHNESS	FORB RICHNESS	FERN RICHNESS	OTHER RICHNESS	TREE COVER	SHRUB COVER	GRASS COVER	FORB COVER	FERN COVER	OTHER COVER	LENGTH TIMBER	LEAF LITTER	LARGE TREE
BM[1]	**4**	**8**	**8**	**7**	**2**	**3**	**21**	**21**	**73**	**3**	**1**	**1**	**12**	**40**	**1**
Q3	1	1	3	2	0	2	35	1	20	0.2	0	0.2	3	44	0
Q4	2	5	9	2	0	3	35.4	12.1	10	0.6	0	3.5	2	68	0
Q5	2	3	3	5	1	4	7	11.1	4.9	4	0.6	1.1	0	56	3
Q6	3	3	3	4	0	3	21	9.6	4.8	2.5	0	1.4	0	50	0

(1) Benchmark data for equivalent community in NSW Sydney Basin IBRA Bioregion; Vegetation Type – PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion; Keith Formation: KF_CH9 Forested Wetland; Keith Class: Coastal Floodplain Wetland; source NSW BioNet Vegetation Classification database accessed October 2018.

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3.2.1.3 PCT 849 GREY BOX - FOREST RED GUM GRASSY WOODLAND ON FLATS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION

The occurrence of this vegetation type within the study area is illustrated in Figure 3.2 with photographic representation provided in Photo 3.9 to Photo 3.12. A profile of PCT 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion is provided in Table 3.7 and a comparison of recorded vegetation integrity data against community condition benchmark data is presented in Table 3.8.

Table 3.7 Summary of recorded attributes for PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

PCT 849 GREY BOX - FOREST RED GUM GRASSY WOODLAND ON FLATS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION	
PCT Justification	In assigning this vegetation type, the following three candidate PCTs were considered based on floristic similarities and given the communities are known to intergrade: — PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion — PCT 725 – Broad-leaved Ironbark – Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion — PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion. The presence of *Eucalyptus moluccana* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum)
Vegetation formation	KF_CH3 Grassy Woodlands
Vegetation class	Coastal Valley Grassy Woodlands
Vegetation zone	VZ4 – Moderate condition class
Conservation status:	BC Act – Cumberland Plain Woodland in the Sydney Basin Bioregion – Critically Endangered EPBC Act – Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – Critically Endangered One threatened flora species was recorded within this vegetation type: — *Grevillea juniperina* subsp. *juniperina* (Juniper-leaved Grevillea) – Vulnerable (BC Act).
Percent cleared	93%
Vegetation integrity plots	Q10
Landscape position	Recorded adjacent to alluvial soils in areas slightly elevated in the landscape.
Species upper stratum	*Eucalyptus moluccana* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum) with *Eucalyptus eugenoides* (Thin-leaved Stringybark) and *Angophora floribunda* (Rough-barked Apple) nearby.
Species middle stratum	*Melaleuca decora* (White Feather Myrtle) with *Acacia falcata* (Hickory Wattle) and *Acacia parramattensis* (Parramatta Wattle) nearby
Species ground stratum	*Aristida ramosa* (Purple Wiregrass), *Cheilanthes sieberi subsp. sieberi* (Mulga Fern), *Commelina cyanea* (Native Wandering Jew), *Glycine tabacina*, *Microlaena stipoides var. stipoides* (Weeping Meadow Grass), *Paspalidium distans*, *Wahlenbergia communis* (Tufted Bluebell)
Vegetation condition	Vegetation was recorded in Moderate condition class and displayed a native canopy cover and regeneration of canopy species. This condition class has been subject to historical disturbances and ongoing weed incursions particularly from the perennial exotic grass *Eragrostis curvula** (African Love Grass).
Extent within the Proposal footprint	0.55 ha

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Photo 3.9 PCT 849 recorded in the northern section of the study area adjacent to Links Road



Photo 3.10 *Eucalyptus moluccana* (Grey Box) recorded within PCT 849



Photo 3.11 PCT 849 recorded within the Vegetation Exclusion Zone



Photo 3.12 Juvenile *Eucalyptus moluccana* (Grey Box) with a predominately exotic understorey dominated by *Eragrosits curvula** (African Love Grass)

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Table 3.8 Comparison of PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion vegetation integrity plot data against PCT condition benchmark data

PLOT	TREE RICHNESS	SHRUB RICHNESS	GRASS RICHNESS	FORB RICHNESS	FERN RICHNESS	OTHER RICHNESS	TREE COVER	SHRUB COVER	GRASS COVER	FORB COVER	FERN COVER	OTHER COVER	LENGTH TIMBER	LEAF LITTER	LARGE TREE
BM[1]	**5**	**8**	**12**	**15**	**2**	**5**	**52**	**18**	**61**	**10**	**1**	**4**	**40**	**35**	**3**
Q10	2	1	4	2	1	1	25	0.1	5.4	0.2	0.2	0.1	4	25	3

(1) Benchmark data for equivalent community in NSW Sydney Basin IBRA Bioregion; Vegetation Type - 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion; Keith Formation: KF_CH3 Grassy Woodlands; Keith Class: Coastal Valley Grassy Woodlands; source NSW BioNet Vegetation Classification database accessed October 2018.

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3.2.2 NON-NATIVE VEGETATION TYPES

A total of two non-native vegetation types were assigned to a miscellaneous ecosystem class, being:

— Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation
— Miscellaneous ecosystem – urban exotic/native landscape plantings.

A brief description of each non-native vegetation type is provided below.

3.2.2.1 MISCELLANEOUS ECOSYSTEM – HIGHLY DISTURBED AREAS WITH NO OR LIMITED NATIVE VEGETATION

This non-native vegetation type was the dominate vegetation type within the Proposal footprint and occupied 5.86 ha. Generally, this vegetation was recorded in areas which have experienced disturbances such as land fill, clearing and subsequent weed invasion. As a result, native species richness is low and floristic assemblage present is unable to be assigned to a recognised NSW PCT. This vegetation type can however provide habitat for threatened species as illustrated in Photo 3.13 where *Grevillea juniperina* subsp. *juniperina* (Juniper-leaved Grevillea) was recorded in exotic vegetation dominated by *Rubus fruticosus* agg.* (Blackberry).



Photo 3.13 Exotic vegetation dominated by *Rubus fruticosus** (Blackberry) near Dunheved Golf Course



Photo 3.14 Weeds and exotic species recorded in cleared areas in the northern section of the study area adjacent to Links Road

3.2.2.2 MISCELLANEOUS ECOSYSTEM – URBAN EXOTIC / NATIVE LANDSCAPE PLANTINGS

This vegetation type consists of both native and exotic species planted in areas previously cleared areas and occupied 0.12 ha within the Proposal footprint. This vegetation does not align to any recognised plant community type in NSW and has been assigned to urban exotic/native landscape plantings. Within the Proposal footprint this vegetation type was recorded within proximity to Dunheved Golf Club and adjacent to Links Road as illustrated in Photo 3.15 and Photo 3.16.

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Photo 3.15 *Populus* spp. planted along Links Road



Photo 3.16 Planted native eucalypts along Links Road

3.3 PRIORITY WEEDS

One hundred and eighty-six (186) species recorded within the study area, of these 113 are native and 73 are exotic species. Of the 73 exotic species recorded, 29 are listed as High Threat weeds under the BC Act, six species are listed as priority weeds under the NSW *Biosecurity Act 2015* (BA Act) for the Greater Sydney region and six are listed as Weeds of National Significance (WoNS) (Australian Weeds Committee, 2018). Table 3.9 outlines weeds identified within the study area and their associated listings.

Table 3.9 Priority weeds identified within the study area

SCIENTIFIC NAME	COMMON NAME	HIGH THREAT WEEDS (BAM)	DUTY UNDER THE BA ACT[1]	WONS
*Ageratina adenophora**	Crofton Weed	HT	–	–
*Andropogon virginicus**	Whiskey Grass	HT	–	–
*Araujia sericifera**	Moth Vine	HT	–	–
*Asparagus aethiopicus**	Asparagus Fern	HT	–	Yes
*Asparagus asparagoides**	Bridal Creeper	HT	Prohibition on dealings	Yes
*Bryophyllum delagoense**	Mother-of-Millions	HT	–	–
*Cenchrus ciliaris**	Buffel Grass	HT	–	–
*Chloris gayana**	Rhodes Grass	HT	–	–
*Cortaderia selloana**	Pampas Grass	HT	–	–
Cotoneaster sp.*	–	HT	–	–
*Cyperus eragrostis**	–	HT	–	–
*Ehrharta erecta**	Ehrharta	HT	–	–
*Eragrostis curvula**	African Love Grass	HT	–	–
*Genista monspessulana**	–	HT	–	–
*Ligustrum lucidum**	Large-leaf Privet	HT	–	–

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SCIENTIFIC NAME	COMMON NAME	HIGH THREAT WEEDS (BAM)	DUTY UNDER THE BA ACT[1]	WONS
*Ligustrum sinense**	Small-leaf Privet	HT	–	–
*Lonicera japonica**	Japanese Honeysuckle	HT	–	–
*Lycium ferocissimum**	African Box Thorn	HT	Prohibition on dealings	Yes
*Ochna serrulata**	Mickey Mouse Plant	HT	–	–
*Olea europaea**	African Olive	HT	Regional recommended measure	
*Opuntia spp.**	Prickly Pear sp.	HT	Prohibition on dealings	Yes
*Paspalum dilatatum**	Paspalum	HT	–	–
*Populus spp.**	Poplar sp.	HT	–	–
*Ricinus communis**	Castor Oil Plant	HT	–	–
Rubus fruticosus agg.*	Blackberry	HT	Prohibition on dealings	Yes
*Senecio madagascariensis**	Fireweed	HT	Prohibition on dealings	Yes
*Stenotaphrum secundatum**	Buffalo Grass	HT	–	–

(1) Prohibition on dealings: This species must not be imported into the State or sold; Regional Recommended Measure: An exclusion zone is established for all lands in Blue Mountains City Council and Central Coast local government areas.

3.4 RECORDED FAUNA

A total of 36 fauna species were recorded during field investigations which included 1 amphibian, 30 birds, 3 mammals and 1 reptile (Appendix D). Of the 36-fauna species observed, four were exotic species. One threatened fauna species was recorded during field investigations; Cumberland Plain Land Snail (*Meridolum corneovirens*). Further information on threatened species recorded or considered likely to occur within the study area are discussed in section 4.

3.5 FAUNA HABITATS

Those fauna habitats identified within the study area include open sclerophyll woodland in the form of grassy woodlands and open forests, and disturbed land with limited native vegetation. Each fauna habitat is described in detail below and assessed under the criteria described in sections below.

3.5.1 OPEN SCLEROPHYLL WOODLAND

Vegetation associated with this fauna habitat included:

- PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion
- PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion.

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These vegetation types were partially disturbed in nature and overall were in a poor to medium condition (Photo 3.17 and Photo 3.18). Due to current and previous land uses (i.e. agricultural and industrial practices) and the Proposal's location within a largely urbanised landscape, most the study area displayed an understorey which was heavily disturbed with minimal ground and mid-storey cover present. Disturbance due to rubbish dumping and human activity has resulted in minimal ground structure (i.e. fallen timber, rocks, and small shrubs) particularly along Links Road, and in some areas, ground structure was non-existent. Despite this, some areas had presence of fallen timber and dumped rubbish/building materials which provide some microhabitat for ground dwelling reptiles, invertebrates and small mammals. However due to the study area's location within a fragmented highly urbanised landscape, species likely to occur are those well adapted to fragmented urban landscapes.

The canopy of this vegetation formed a low to moderate cover of semi-mature to mature trees. Canopy species included *Eucalyptus moluccana* (Grey Box), *Eucalyptus amplifolia* subsp. *amplifolia* (Cabbage Gum), *Eucalyptus tereticornis* (Forest Red Gum), *Angophora floribunda* (Rough-barked Apple) and *Eucalyptus fibrosa* (Red Ironbark), These canopy species provide suitable foraging habitat for nectar feeding (i.e. Honeyeaters and Lorikeets) and seed-eating fauna. Remnant *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus amplifolia* subsp. *amplifolia* (Cabbage Gum) along the riparian area also provide some small hollows and stags suitable for roosting opportunities for microchiropteran bats.



Photo 3.17 Grassy woodland (PCT 835)



Photo 3.18 Open Forest (PCT 724)

3.5.2 HIGHLY DISTURBED AREAS WITH NO OR LIMITED NATIVE VEGETATION

This habitat type occurred in large areas of the study area in association with areas adjacent to road reserves, or subject to disturbance from urban development or historical agricultural practices. This fauna habitat type corresponds with the miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation and is depicted below in Photo 3.19 and Photo 3.20. This area has been cleared of its original vegetation to be utilised for either agricultural or industrial activities and occurs as either exotic open grassland or exotic dominated vegetation with the presence of some limited native vegetation. The ground cover is dominated with exotic grasses and herbaceous weeds. Very limited fallen timber or rocky habitat was identified in these areas. These areas are likely to provide foraging habitat for common species typical of disturbed environments or parklands (i.e. Australian Magpie, Magpie-lark and Masked Lapwing).

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Photo 3.19 Road reserve along Links Road



Photo 3.20 Disturbed grassland

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4 THREATENED BIODIVERSITY

Threatened biodiversity (species, populations and communities) are listed under the NSW *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act) or Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

This section includes an overview of the threatened biodiversity that has been previously recorded, was recorded during field surveys or has a moderate to high likelihood of occurrence within the study area.

4.1 THREATENED ECOLOGICAL COMMUNITIES

A total of three threatened ecological communities listed under the BC Act were recorded to occur within the study area. These are:

- Cumberland Plain Woodland in the Sydney Basin Bioregion
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Shale Gravel Transition Forest in the Sydney Basin Bioregion.

A summary of each threatened ecological community listed above, associated PCT and extent within the Proposal footprint is summarised in Table 4.1.

Table 4.1 A summary of threatened ecological communities listed under the BC Act recorded within the study area

THREATENED ECOLOGICAL COMMUNITY	STATUS	VEGETATION TYPE	VEGETATION ZONE	EXTENT IN PROPOSAL FOOTPRINT (ha)
Shale Gravel Transition Forest in the Sydney Basin Bioregion	E	PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	VZ1, VZ2	1.39 ha
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	VZ3	1.91 ha
Cumberland Plain Woodland in the Sydney Basin Bioregion	CE	PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	VZ4	0.55 ha
Total				3.85 ha

A description of each threatened ecological community includes specific details of how each PCT meets each element of the scientific determination, including characteristic species, details of the soils and geology associated with the listing is provided in Table 4.2 to Table 4.4 with the location of each shown in Figure 4.2.

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4.1.1 SHALE GRAVEL TRANSITION FOREST IN THE SYDNEY BASIN BIOREGION

Table 4.2 Correlation of BC Act-listed Shale Gravel Transition Forest in the Sydney Basin Bioregion and associated PCT 724

TEC & PCT COMPARISON	BIOREGION	LANDFORM AND ALTITUDINAL RANGE	SOIL / GEOLOGY	STRUCTURE	SPECIES ASSEMBLAGE	CONDITION THRESHOLD
Shale Gravel Transition Forest in the Sydney Basin Bioregion	Sydney basin bioregion	Shale Gravel Transition Forest is or has been known to occur in the Auburn, Bankstown, Baulkham Hills, Blacktown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta and Penrith Local Government Areas, but may occur elsewhere in the Sydney Basin Bioregion.	Occurs on clay soils on tertiary alluvium, or on shale soils on Wianamatta Shale including the Birrong Soil Landscape and associated shale lowlands.	Open-forest structure, usually with trees of *Eucalyptus fibrosa* sometimes with *Eucalyptus moluccana* and *Eucalyptus tereticornis, Melaleuca decora* is frequently present in a small tree stratum. A sparse shrub stratum is usually present with species such as *Bursaria spinosa, Daviesia ulicifolia* and *Lissanthe strigosa*. Ground-layer species include *Microlaena stipoides, Cheilanthes sieberi, Themeda australis, Opercularia diphylla, Lomandra multiflora subsp. Multiflora, Aristida vagans, Pratia purpurascens* and *Wahlenbergia gracilis.*	There are 43 characteristics species. The total species list of flora and fauna of the community is considerably larger with many species present in only one or two sites or in very small quantity.	There is no condition threshold described for this community in the determination.

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TEC & PCT COMPARISON	BIOREGION	LANDFORM AND ALTITUDINAL RANGE	SOIL / GEOLOGY	STRUCTURE	SPECIES ASSEMBLAGE	CONDITION THRESHOLD
PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	Sydney Basin	The site occurs within both Black City Council and Penrith City Council Local Government Areas	Occurs on iron-indurated gravels derived from Tertiary alluvium.	Medium condition – occurs as an open forest dominated by *Eucalyptus fibrosa*, *Eucalyptus moluccana* and *Eucalyptus tereticornis*. Mid stratum and ground stratum species recorded are representative of Shale Gravel Transition Forest. Poor condition – occurs as regrowth due to historical clearing. Native species recorded are representative of Shale Gravel Transition Forest.	Medium condition – Q1 22/34 of the native species recorded are characteristic. Poor condition – Q11 – 6/14 of the native species recorded are characteristic.	-
Conclusion	**Meets criterion**	**Meets criterion**	**Meets criterion**	**Meets criterion**	**Meets criterion**	**Meets criterion**

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4.1.2 RIVER-FLAT EUCALYPT FOREST

Table 4.3 Correlation of BC Act-listed River-Flat Eucalypt Forest Community and associated PCT 835

TEC & PCT COMPARISON	BIOREGION	LANDFORM AND ALTITUDINAL RANGE	SOIL / GEOLOGY	STRUCTURE	SPECIES ASSEMBLAGE	CONDITION THRESHOLD
River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions Threatened Ecological Community	North Coast, Sydney Basin and South East Corner bioregions	Found on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level.	Alluvium; silts, clay-loams and sandy loams	The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees.	There are 88 characteristic species listed for this community. The total species list of the community is larger with many species present at a small number of sites or in low abundance.	There is no condition threshold described for this community in the determination.
PCT 835: Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Sydney Basin	Occurs on streams/drainage lines at <50 m elevation within the study area.	Occurs on alluvium and clay-loams within the study area.	Occurs as a grassy woodland	Of the 35 native species recorded within sampling plots Q3, Q4, Q5, Q6, 21 of the species are listed as characteristic for this community.	-
Conclusion	**Meets criterion**	**Meets criterion**	**Meets criterion**	**Meets criterion**	**Meets criterion**	**Meets criterion**

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4.1.3 CUMBERLAND PLAIN WOODLAND IN THE SYDNEY BASIN BIOREGION

Table 4.4 Correlation of BC Act-listed Cumberland Plain Woodland Community and associated PCT 849

TEC & PCT COMPARISON	BIOREGION	LANDFORM AND ALTITUDINAL RANGE	SOIL / GEOLOGY	STRUCTURE	SPECIES ASSEMBLAGE	CONDITION THRESHOLD
Cumberland Plain Woodland in the Sydney Basin Bioregion Threatened Ecological Community	Sydney Basin	Typically occurs on flat to undulating or hilly terrain up to about 350 m elevation but may also occur on locally steep sites and at slightly higher elevations.	Clay soils derived from Wianamatta Group geology, or more rarely alluvial substrates	In relatively undisturbed condition, it has an open tree canopy, a near-continuous groundcover dominated by grasses and herbs, sometimes with layers of shrubs and/or small trees. May also occur as regrowth dominated by shrubs and saplings or as derived grassland.	There are 112 characteristic species listed for this community. The total species list of the community is larger with many species present at a small number of sites or in low abundance.	There is no condition threshold described for this community in the determination.
PCT 849: Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Sydney Basin	Occurs on flat to slightly undulating land at <50 m elevation across the site.	Clay soils derived from Wianamatta Group geology	Occurs as an open woodland with a continuous tree canopy comprised of characteristic canopy species.	Of the 11 native species recorded in sampling plot Q10, 8 are species are characteristic of this community.	-
Conclusion	**Meets criterion**	**Meets criterion**	**Meets criterion**	**Meets criterion**	**Meets criterion**	**Meets criterion**

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4.2 THREATENED FLORA SPECIES

Background research identified 24 threatened flora species that have been previously recorded or have the potential to occur within the locality of the study area. Each species was subject to a likelihood of occurrence assessment (Appendix A) which identified eight threatened flora species as having a moderate to high likelihood of occurrence, these species became candidate species and were the subject of targeted flora surveys.

During field surveys, three threatened flora species were recorded; *Dillwynia tenuifolia*, *Grevillea juniperina* subsp. *juniperina* and *Pultenaea parviflora*, and are discussed further in Table 4.5 and Section 4.2.1 to 0. The remaining five threatened flora species were not recorded within the study area despite targeted flora surveys, as such they are not considered affected by the Proposal and are given no further consideration.

Table 4.5 Candidate species

SPECIES NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	LIKELIHOOD OF OCCURRENCE	AFFECTED SPECIES
Acacia pubescens	Downy Wattle	V	V	Moderate	No – No individuals were recorded.
Dillwynia tenuifolia	–	V	–	**Recorded**	**Yes –** This species was recorded in PCT 724. During field surveys, nine individuals were recorded.
Grevillea juniperina subsp. *juniperina*	Juniper-leaved Grevillea	V	–	**Recorded**	**Yes –** This species was recorded in all plant community types and vegetation types within the study area. During field surveys, 1,273 individuals were recorded.
Hibbertia fumana	–	CE	–	Moderate	No – A *Hibbertia* sp. with similar leaf morphology and form to *Hibbertia fumana* was recorded during field surveys and sampled. Samples were forwarded to the National Herbarium of New South Wales for positive identification. All samples were identified as *Hibbertia pedunculata* (RBG Enquiry No. BIS 20780). No *Hibbertia fumana* individuals were recorded.
Micromyrtus minutiflora	–	E1	V	Moderate	No – No individuals were recorded.
Persoonia nutans	Nodding Geebung	E1	E	Moderate	No – No individuals were recorded.
Pimelea spicata	Spiked Rice-flower	E1	E	Moderate	No – No individuals were recorded.
Pultenaea parviflora	–	E1	V	**Recorded**	**Yes –** This species was recorded in PCT 835 and PCT 724. During field surveys, 45 individuals were recorded.

(1) V = Vulnerable, E1 = Endangered species listed under the BC Act

(2) V = Vulnerable, E = Endangered listed under the EPBC Act

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4.2.1 DILLWYNIA TENUIFOLIA

Dillwynia tenuifolia is a threatened flora species listed as Vulnerable under the BC Act.

Dillwynia tenuifolia is known to occur in western Sydney within scrubby/dry heath areas in Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. It has also been previously recorded within close proximity to the study area (Atlas of Living Australia, 2018). *Eucalyptus fibrosa* is usually the dominant canopy species in associated habitat with *Melaleuca decora* frequently forming a secondary canopy layer. Associated species may include *Allocasuarina littoralis, Angophora bakeri, Aristida spp. Banksia spinulosa, Cryptandra* spp. *Daviesia ulicifolia, Entolasia stricta, Hakea sericea, Lissanthe strigosa, Melaleuca nodosa, Ozothamnus diosmifolius* and *Themeda triandra. Dillwynia tenuifolia* is often found in association with other threatened species such as *Dodonaea falcata, Grevillea juniperina, Micromyrtus minutiflora, Pultenaea parviflora* and *Styphelia laeta* (Office of Environment and Heritage, 2018).

Within the study area, two recorded Plant Community Types form associated habitat for *Dillwynia tenuifolia* (PCT 724 and PCT 849). Each PCT was subject to Targeted flora surveys in the form of parallel transects and random meanders.

Nine individuals of *Dillwynia tenuifolia* were recorded in the study area during field surveys. All recorded were recorded in PCT 724 Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion in Moderate condition vegetation. Photo 4.1 and Photo 4.2 illustrate the different forms *Dillwynia tenuifolia* was recorded in. Figure 4.2 shows the distribution of the species within the study area.



Photo 4.1 *Dillwynia tenuifolia* habitat recorded in PCT 724 (moderate condition)



Photo 4.2 Sample of *Dillwynia tenuifolia* collected from the study area that was forwarded to the National Herbarium of New South Wales

4.2.2 GREVILLEA JUNIPERINA SUBSP. JUNIPERINA

Grevillea juniperina subsp. *juniperina* is a threatened flora species listed as Vulnerable under the BC Act.

Grevillea juniperina subsp. *juniperina* is endemic to Western Sydney, centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town. This species has been previously recorded within the study area.

This threatened species is known to grow on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels with associated habitat including Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest.

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Associated canopy species within Cumberland Plain Woodland and Shale/Gravel Transition Forest include *Eucalyptus tereticornis, E. moluccana, E. crebra, E. fibrosa* and *E. eugenioides*. Understorey species include *Bursaria spinosa, Dillwynia sieberi, Ozothamnus diosmifolius, Daviesia ulicifolia, Acacia falcata, Acacia parramattensis, Themeda triandra, Aristida ramosa, Cymbopogon refractus, Eragrostis brownii, Cheilanthes sieberi, Dianella revoluta* and *Goodenia hederacea* (Office of Environment and Heritage, 2018).

Within the broader study area, three recorded Plant Community Types form associated habitat for *Grevillea juniperina* subsp. *juniperina* (PCT 724, PCT 849 and PCT 835). Individuals of this species were also recorded within adjacent highly disturbed areas with no or limited native vegetation. The Proposal footprint and adjoining patches of native vegetation were subject to targeted flora surveys in the form of parallel field traverses.

A total of 1, 273 individuals of *Grevillea juniperina* subsp. *juniperina* individuals were recorded during field surveys within the following vegetation types:

- PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion
- PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- Miscellaneous Ecosystem (Highly disturbed areas with no or limited native vegetation)

Grevillea juniperina subsp. *juniperina* is known to colonise mechanically disturbed areas where open ground surface persists (R.O. Makinson 2000). This appears to be the case for study area that has been subject to historic disturbances and modification, most recently as part of the decommissioning of the Ropes Creek railway line that was built during World War II to service the St Marys munition factory site.

The population within the study area is considered to form part of a larger local population that includes the Shane's Park saving our species key management site that incorporates both public and private lands and covers about 2,897 hectares (Figure 4.1) (OEH 2018).

This Photo 4.3 and Photo 4.4 illustrate specimens recorded. The distribution of the species within the study area is shown in Figure 4.2.



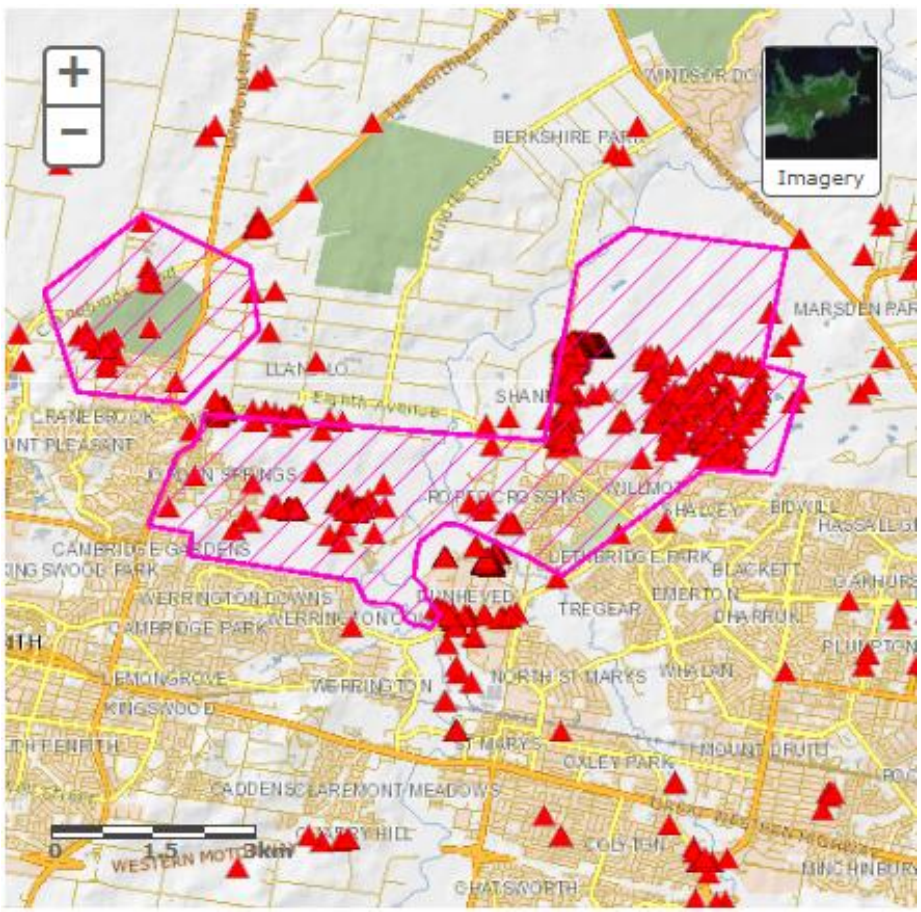
Photo 4.3 *Grevillea Juniperina Subsp. Juniperina* Flower

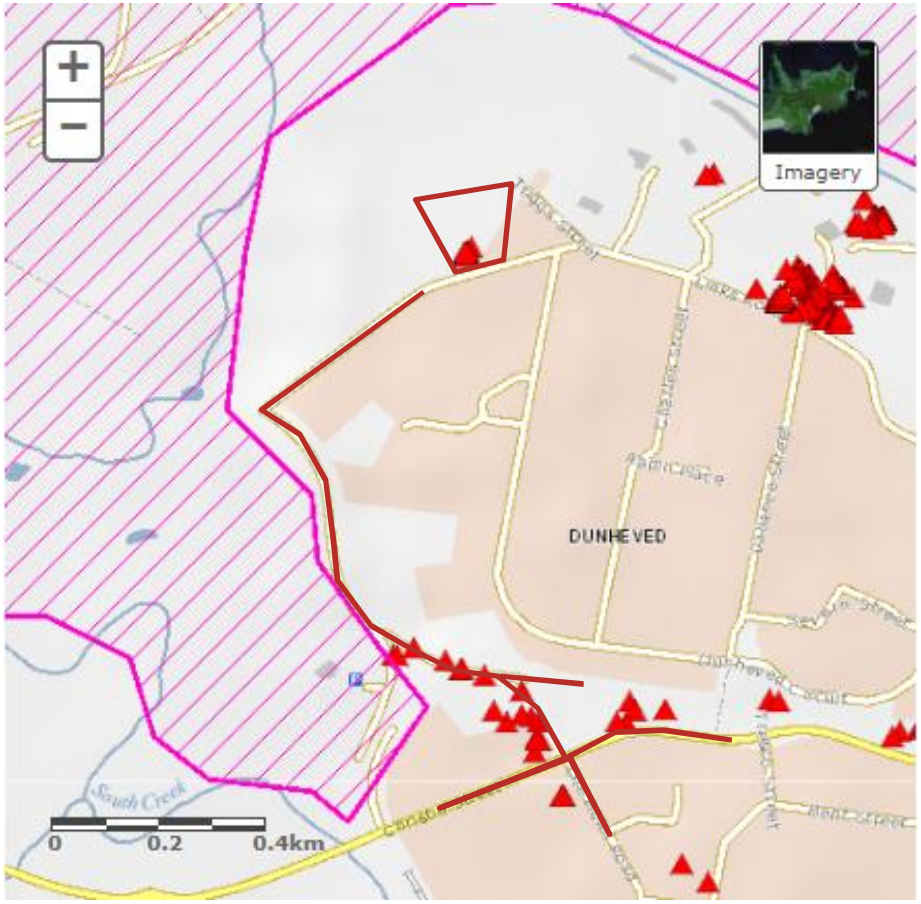


Photo 4.4 *Grevillea Juniperina Subsp. Juniperina* recorded In *Eragrostis Curvula** (African Love Grass)

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Figure 4.1 *Grevillea juniperina* subsp. *juniperina* saving our species key management site for Shane's park





▲ = NSW Wildlife Atlas Records
□ = Shane's Park Key Management Site

▲ = NSW Wildlife Atlas Records
□ = Shane's Park Key Management Site
— = Approximate Proposal Footprint

Source: OEH 2018 https://www.environment.nsw.gov.au/savingourspeciesapp/ManagementSite.aspx?SiteID=612 accessed 12/11/2018

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4.2.3 PULTENAEA PARVIFLORA

Pultenaea parviflora is a threatened flora species listed as Endangered under the BC Act and Vulnerable under the EPBC Act.

Pultenaea parviflora is known to occur within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. This species was previously recorded within close proximity to the study area (Atlas of Living Australia, 2018).

Associated habitat includes vegetation dominated by *Eucalyptus fibrosa* with *Melaleuca decora* frequently forming a secondary canopy layer. Associated species may include *Allocasuarina littoralis, Angophora bakeri, Aristida spp. Banksia spinulosa, Cryptandra spp., Daviesia ulicifolia, Dodonaea falcata, Entolasia stricta, Hakea sericea, Lissanthe strigosa, Melaleuca nodosa, Ozothamnus diosmifolius, Styphelia laeta* and *Themeda triandra. Pultenaea parviflora* is found in association with other threatened species such as *Dillwynia tenuifolia, Grevillea juniperina, Micromyrtus minutiflora* and *Persoonia nutans.*

Within the study area, PCT 724 Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion was identified to form associated habitat for this species. This vegetation type was subject to targeted flora surveys in the form of parallel field traverses.

Forty-five *Pultenaea parviflora* individuals were recorded during field surveys, mostly within PCT 724 although two individuals were recorded from PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion. A collected sample of this species was confirmed by the National Herbarium of New South Wales (Appendix F).

Photo 4.5 and Photo 4.6 illustrate specimens of *Pultenaea parviflora* recorded within the study area. The distribution of the species within the study area is shown in Figure 4.2. *Pultenaea parviflora* is a Commonwealth-listed threatened flora species and as such has been addressed in Section 4.4.2 of this report.



Photo 4.5 *Pultenaea Parviflora* recorded within PCT 724



Photo 4.6 *Pultenaea Parviflora* recorded in flower

4.3 THREATENED FAUNA SPECIES

Background investigations identified 59 threatened fauna species listed under the BC Act that have been previously recorded or have the potential to occur within the locality (Appendix B). During field surveys, one threatened fauna species was recorded within the study area; the Cumberland Plain Land Snail (*Meridolum corneovirens*) (Figure 4.2). Of the 59 threatened fauna species identified, a total of 18 species have been recorded or considered to have a moderate to high likelihood to occur within the study area (Table 4.6). The likelihood of these species occurring within the study area was determined based on field investigations and fauna habitat availability.

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Table 4.6 Threatened fauna recorded or with a moderate to high likelihood of occurrence in the study area

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	LIKELIHOOD OF OCCURRENCE
Birds				
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	–	**Moderate** – potential foraging habitat identified within study area.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	–	**Moderate** – potential foraging habitat within study area.
Chthonicola sagittata (syn. Pyrrholaemus sagittatus)	Speckled Warbler	V	–	**Moderate** – potential foraging habitat within study area.
Daphoenositta chrysoptera	Varied Sittella	V	–	**Moderate** – potential foraging habitat within study area.
Glossopsitta pusilla	Little Lorikeet	V	–	**Moderate** – potential foraging habitat within study area.
Hieraaetus morphnoides	Little Eagle	V	–	**Moderate** – potential foraging habitat available in study area
Lophoictinia isura	Square-tailed Kite	V	–	**Moderate** – potential foraging habitat within study area.
Ninox strenua	Powerful Owl	V	–	**Moderate** – potential foraging habitat available in study area. Recent records within locality.
Invertebrates				
Meridolum corneovirens	Cumberland Plain Land Snail	E	–	**Recorded.** This species was recorded in PCT 849.
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	**Moderate** – foraging habitat identified within study area.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	–	**Moderate** – foraging and potential roosting habitat identified within study area.
Miniopterus australis	Little Bent-wing Bat	V	–	**Moderate** – foraging habitat identified within study area.
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	–	**Moderate** – foraging habitat identified within study area.
Mormopterus (Micronomus) norfolkensis	Eastern Freetail Bat	V	–	**High** – foraging and potential roosting habitat identified within study area
Myotis macropus	Southern Myotis	V	–	**Moderate** – previously recorded adjacent to study area in association with South Creek tributaries and adjacent waterbodies.

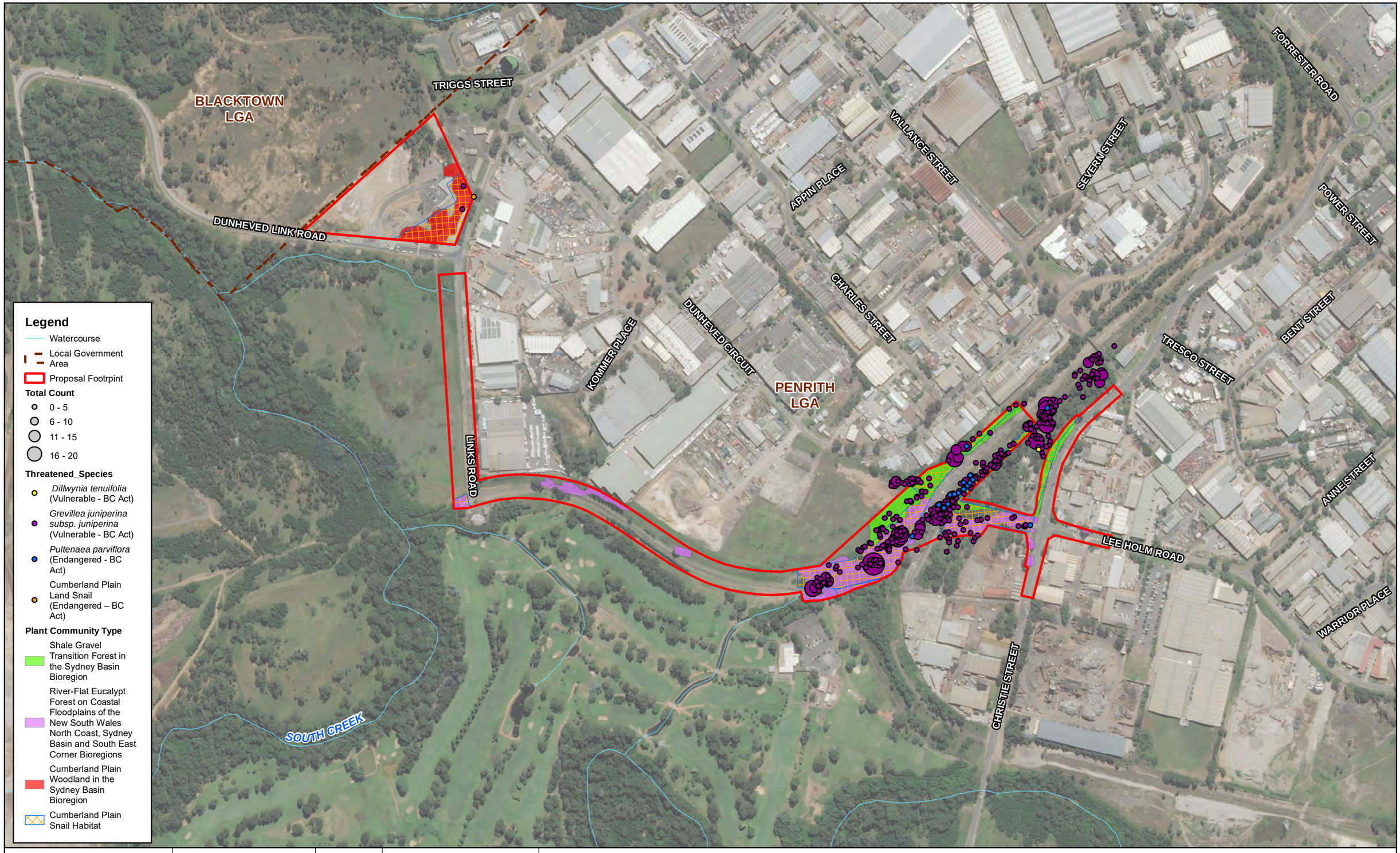
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SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	LIKELIHOOD OF OCCURRENCE
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	**High** – foraging habitat identified within study area.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	–	**Moderate** – foraging and potential roosting habitat identified within study area.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	–	**Moderate** – foraging and potential roosting habitat identified within study area.

(1) V = Vulnerable, E1 = Endangered species listed under the BC Act

(2) V = Vulnerable, E = Endangered listed under the EPBC Act

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Map: PS111235_GIS_005_A5	Author: David.Naiken
Date: 15/11/2018	Approved by: Julia.Wyllie

0 50 100 m
1:6,000

Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

Data Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

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Links Road Extension: Biodiversity Assessment Report

Figure 4.2
BC Act listed threatened biodiversity recorded within the Study Area

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4.4 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (MNES)

The focus of this section is threatened species, populations, communities and migratory species listed under the EPBC Act. It also included a discussion of the following MNES as they relate to biodiversity:

— World and national heritage
— Wetlands of international and national importance.

4.4.1 NATIONALLY THREATENED ECOLOGICAL COMMUNITIES

Within the study area, two Plant Community Types, which align to nationally listed threatened ecological communities, were recorded. For each Plant Community Type to meet EPBC status, each patch must meet the key diagnostic characteristics and condition thresholds outlined by the Threatened Species Scientific Committee (2009). Table 4.7 shows a summary the findings for each Plant Community Type and condition class.

Table 4.7 EPBC listed ecological communities recorded within the study area

PCT	CONDITION CLASS	EPBC ACT STATUS	AREA (ha)
PCT 724 Broad-leaved Ironbark – Grey Box Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Critically Endangered)	0.90 ha
	Poor	Not listed	Not listed
PCT 849: Grey box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Not listed	Not listed

4.4.1.1 SHALE-GRAVEL TRANSITION FOREST

The listing advice for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest outlines the criteria required for a patch of PCT 724 and PCT 849 to meet EPBC Status (Threatened Species Scientific Committee, 2009). Vegetation must always have an upper tree layer species present and either a shrub or ground layer present, as such Poor condition form of PCT 724 cannot be listed under the EPBC Act.

The Moderate condition forms of PCT 724 and PCT 849 within the study area have been assessed against the condition thresholds for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest in Table 4.8 below.

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Table 4.8 Correlation of EPBC Act-listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest Community and associated PCT 724 and PCT 849

CATEGORY AND RATIONALE	THRESHOLD	WITHIN THREHOLD FOR LISTING?	
		PCT 724 (MODERATE)	PCT 849 (MODERATE)
A. Core thresholds that may apply under most circumstances: patches with an understorey dominated by natives and a minimum size that is functional and consistent with the minimum mapping unit size applied in NSW	Minimum patch size is ≥ 0.5 ha; AND ≥ 50% of the perennial understorey vegetation cover is made up of native species	No. Patch size is >0.5 ha, <50% of the perennial understorey vegetation cover is made up of native species	No. Patch size is <0.5 ha
OR			
B. Large patches which are inherently valuable to their rarity	The patch size is ≥ 5ha; AND ≥ 30% of the perennial understorey vegetation cover is made up of native species	No. This patch is not contiguous with a patch >5 ha.	No. This patch is not contiguous with a patch >5 ha.
OR			
C. Patches with connectivity to other large native vegetation remnants in the landscape	The patch size is ≥ 5 ha; AND ≥ 30% of the perennial understorey vegetation cover is made up of native species; AND The patch is contiguous with a native vegetation remnant that is ≥ 5 ha in area	No**.** Patch is not contiguous with remnant native vegetation ≥ 5 ha in area	No. Patch is not contiguous with remnant native vegetation ≥ 5 ha in area
OR			
D. Patches that have large mature trees or trees with hollows that are very scarce on the Cumberland Plain	The patch is ≥ 0.5 ha in size: AND ≥ 30% of the perennial understorey vegetation cover is made up of native species; AND The patch has at least one tree with hollows per Ha	**Yes**. Patch is ≥ 0.5 ha in size, ≥ 30% of the perennial understorey vegetation cover is made up of native species.	No. Patch is not ≥ 0.5 ha in size, < 30% of the perennial understorey vegetation cover is made up of native species.
Meets criteria?		**Yes**	No

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4.4.2 NATIONALLY THREATENED FLORA SPECIES

Background research identified 24 nationally threatened flora species that have been previously recorded or have the potential to occur within the locality of the study area. Each species was subject to a likelihood of occurrence assessment (Appendix A) which identified eight threatened flora species as having a moderate to high likelihood of occurrence, five of which are listed under the EPBC Act. Each species became candidate species and were the subject of targeted flora surveys.

During field surveys, one EPBC-listed threatened flora species, *Pultenaea parviflora*, was recorded within the study area (Figure 4.3) and is discussed further in Table 4.9 and Section 0. The remaining four threatened flora were not recorded during field surveys despite targeted flora surveys. As such these species are not likely to affected by the Proposal and are given no further consideration.

Table 4.9 EPBC-listed candidate species

SPECIES NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	LIKELIHOOD OF OCCURRENCE	AFFECTED SPECIES
Acacia pubescens	Downy Wattle	V	V	Moderate	No – No individuals were recorded.
Micromyrtus minutiflora	–	E1	V	Moderate	No – No individuals were recorded.
Persoonia nutans	Nodding Geebung	E1	E	Moderate	No – No individuals were recorded.
Pimelea spicata	Spiked Rice-flower	E1	E	Moderate	No – No individuals were recorded.
Pultenaea parviflora	–	E1	V	**Recorded**	**Yes –** This species was recorded in PCT 835 and PCT 724. Forty-five individuals were recorded during field surveys.

(1) V = Vulnerable, E1 = Endangered species listed under the BC Act

(2) V = Vulnerable, E = Endangered listed under the EPBC Act

4.4.3 NATIONALLY THREATENED FAUNA

Results of the threatened species database search and field surveys identified two threatened species listed under the EPBC Act as being considered likely to occur within the study area with a moderate or higher likelihood of occurrence. These species are listed in below in Table 4.10.

Table 4.10 Nationally threatened fauna recorded or with a moderate – high likelihood of occurrence in the study area

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	LIKELIHOOD OF OCCURRENCE
Chalinolobus dwyeri	Large-eared Pied Bat	V	**Moderate** – foraging habitat identified within study area.
Pteropus poliocephalus	Grey-headed Flying-fox	V	**High** – foraging habitat identified within study area.

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4.4.4 MIGRATORY SPECIES LISTED UNDER THE EPBC ACT

Migratory species are protected under international agreements to which Australia are a signatory, including Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA), Republic of Korea-Australia Migratory Bird Agreement (RoKAMBA) and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered Matters of National Environmental Significance and are protected under the EPBC Act.

Based on field investigations, the EPBC Protected Matters area search and other desktop database searches, 15 migratory fauna species were identified that could occur within the locality. Based on field investigations and habitat assessments, one migratory species has a moderate to high likelihood to occur within the study area – Table 4.11.

Table 4.11 Migratory species recorded or have a moderate-high potential to occur with the study area

SCIENTIFIC NAME	COMMON NAME	EPBC ACT	LIKELIHOOD OF OCCURRENCE
Rhipidura rufifrons	Rufous Fantail	Migratory	Moderate

The species identified above in Table 4.11 has the potential to utilise a wide variety of habitats, including native vegetation communities found within the study area. The habitats within the study area are unlikely to constitute important habitat for any of the mentioned species (Table 4.11). The habitat present is unlikely to support significant proportions of the population of any migratory species nor are the habitats critical to any life stage of these species. Due to their mobile nature, the mentioned species is likely to utilise higher quality habitat within the greater locality and where more extensive tracts of native vegetation occur. Because of this, the mentioned species is not considered to be significantly impacted by the action proposed for the construction and operation of the Proposal and is not considered further in this report.

4.4.5 WORLD AND NATIONAL HERITAGE

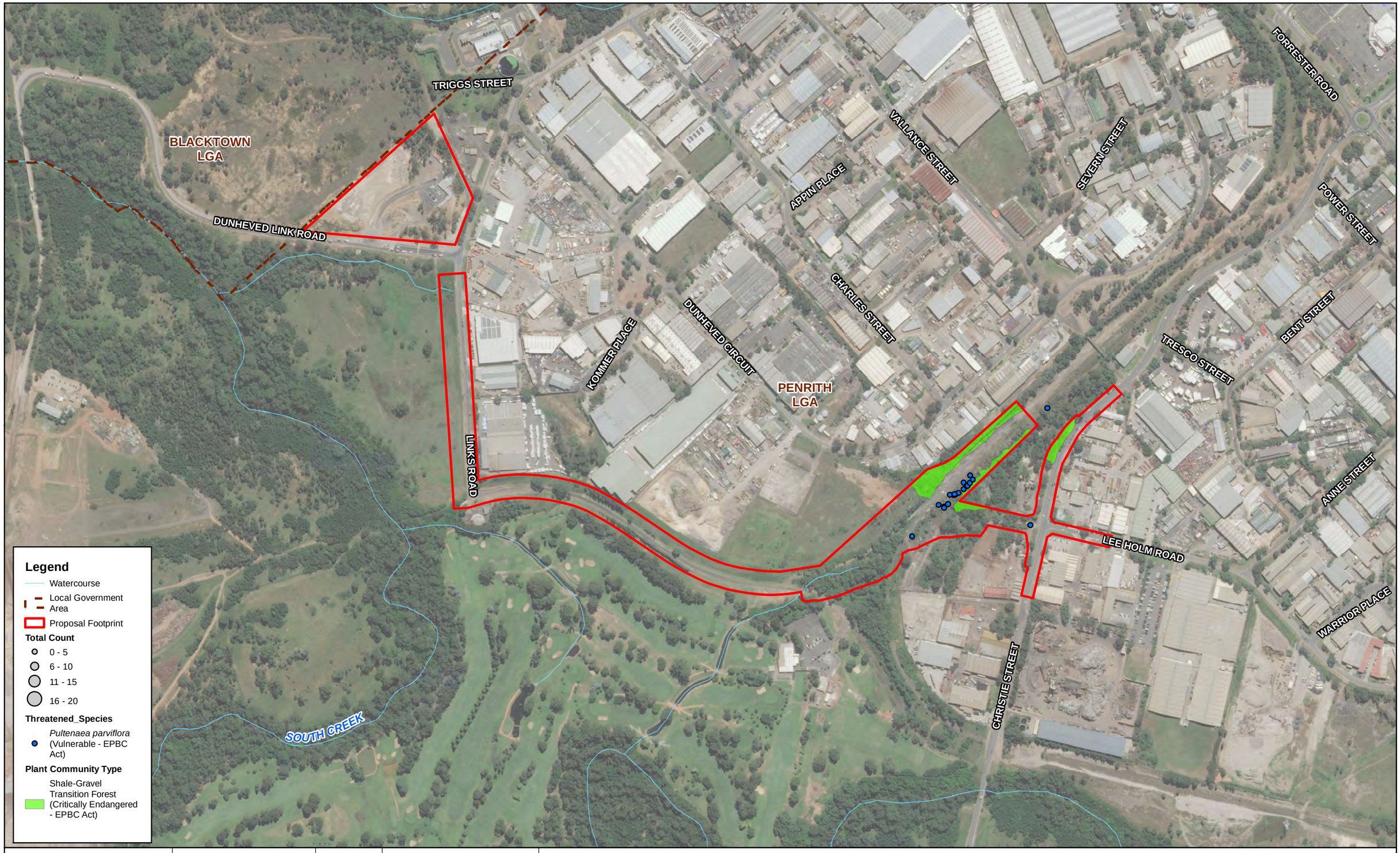
Databases searches revealed no occurrence of any listed world or national heritage places within 10 kilometres of the study area.

4.4.6 WETLANDS OF INTERNATIONAL AND NATIONAL IMPORTANCE

Databases searches revealed no occurrence of any listed wetlands of international and national importance within 10 kilometres of the study area.

An EPBC referral is not considered necessary for threatened species and communities as potential indirect impacts associated with the Proposal are not likely to impact on any specimens or potential habitat for such species or communities. All direct impacts will be restricted to the approved Proposal footprint.

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Map: PS111235_GIS_006_A4	Author: David.Naiken		0 50 100 m 1:6,000
Date: 13/11/2018	Approved by: Julia.Wyllie		*Coordinate system: GDA 1994 MGA Zone 56* Scale ratio correct when printed at A3

Data Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

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Figure 4.3
EPBC Act listed threatened biodiversity recorded within the Study Area

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5 POTENTIAL IMPACTS AND MITIGATION

5.1 POTENTIAL IMPACTS

Potential impacts to biodiversity resulting from the construction and operation phases of the Proposal are considered in this section and summarised in Table 5.1.

Table 5.1 Potential impacts associated with the Proposal

POTENTIAL IMPACT	POTENTIAL PHASE OF IMPACT	
	CONSTRUCTION	OPERATION
Removal of native and non-native vegetation	●	
Removal of threatened flora species and their habitat	●	
Removal of threatened fauna species and their habitat	●	
Aquatic impacts	●	●
Changes to hydrology (including erosion and sedimentation)	●	●
Increase in fauna injury and/or mortality	●	●
Wildlife connectivity and habitat fragmentation	●	●
Edge effects on adjacent native vegetation and habitat	●	●
Potential environmental impact of noise and vibration on wildlife	●	●
Weed and pest invasion	●	●
Invasion and spread of pathogens and disease	●	●

5.1.1 REMOVAL OF NATIVE AND NON-NATIVE VEGETATION

Clearing of native vegetation is listed as a Key Threatening Process under both the BC Act and the EPBC Act. Under the BC Act, native vegetation is made up of plant communities, comprising primarily indigenous species. Clearing is defined as the destruction of a sufficient proportion of one or more strata layers within a stand or stands of native vegetation to result in the loss, or long-term modification, of the structure, composition and ecological function of a stand or stands (NSW Scientific Committee, 2001).

The Proposal would require the clearing of vegetation and habitats as summarised in Table 5.2. This includes the loss of habitat features, such as a seasonal foraging resources and threatened flora species. However, it is evident by the general scarceness of understorey debris, the relatively young age cohort of canopy trees in majority of the study area, the lack of canopy strata in some areas and the dense understorey strata; that the vegetation communities are recovering from previous widespread disturbance. Consequently, the vegetation communities do not occur as old-growth forms and important fauna habitat attributes such as hollows, fallen timber, and large patch size are typically lacking. The general lack of these habitat attributes reduces the study area's capacity for supporting a wide diversity of local native species in isolation from other higher quality habitats in the locality. It is also likely that without these attributes, the study area does not act as important habitat that is heavily relied upon for the majority of threatened species. Nevertheless, the Proposal footprint encompasses approximately 3.85 ha of native vegetation and 5.98 ha of non-native vegetation which form known and potential habitat for 18 threatened fauna species and three threatened flora species. Of the 3.85 ha of

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native vegetation within the Proposal footprint, 2.73 ha will be directly impacted with 1.12 ha retained and protected within Vegetation Exclusion Zones as shown on Figure 3.2.

Table 5.2 Vegetation types recorded within the Proposal footprint

VEGETATION TYPE	PROPOSAL FOOTPRINT (HA)	VEGETATION EXCLUSION ZONES (HA)	PROPOSAL FOOTPRINT IMPACT (HA)
PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion (moderate condition)	0.90	0.57	0.33
PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion (poor condition)	0.49	0.00	0.49
PCT 835 Forest Red Gum-Rough-barked Apple Grassy Woodland on Alluvial Flats of the Cumberland Plain, Sydney Basin (moderate condition)	1.91	0.00	1.91
PCT 849 Grey Box-Forest Red Gum Grassy Woodland on Flats of the Cumberland Plain, Sydney Basin (moderate condition)	0.55	0.55	0.00
Total of native vegetation	**3.85**	**1.12**	**2.73**
Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation	5.86	0.00	5.86
Miscellaneous ecosystem – urban exotic / native landscape plantings	0.12	0.00	0.12
Total of non-native vegetation	**5.98**	**0.00**	**5.98**
Total vegetation to be impacted			**8.71**

5.1.2 REMOVAL OF THREATENED FLORA SPECIES AND THEIR HABITAT

Impact on threatened flora species and their habitat are discussed in this section. Table 5.3 outlines each threatened flora species recorded within the study area, Proposal footprint and individuals recorded outside of Vegetation Exclusion Zones. Individuals recorded outside of Vegetation Exclusion Zones will be directly impacted by the Proposal.

Table 5.3 Impact to threatened flora species recorded within the Proposal footprint

SCIENTIFIC NAME	COMMON NAME	BC ACT STATUS	EPBC ACT STATUS	ASSOCIATED HABITAT	RECORDED DURING FIELD SURVEYS	PROPOSAL FOOTPRINT	EXCLUSION ZONES	PROPOSAL FOOTPRINT IMPACT
Dillwynia tenuifolia	–	V	–	PCT 724	9	0	0	0
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	V	–	PCT 724; PCT 835; PCT 849	1, 273	793	141	652

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Pultenaea parviflora	–	E1	V	PCT 724	45	34	4	30

5.1.3 REMOVAL OF THREATENED FAUNA SPECIES AND THEIR HABITAT

Impact on threatened fauna species, threatened populations and their habitat are discussed in this section. Table 5.4 outlines each candidate species and discusses the potential habitat that would be directly impacted by the Proposal.

Table 5.4 Impact on threatened fauna and their habitats

SPECIES	STATUS		POTENTIAL HABITAT WITHIN THE PROPOSAL FOOTPRINT IMPACT	HABITAT AFFECTED
	BC ACT[1]	EPBC ACT[2]		
Birds – woodland birds				
Dusky Woodswallow	V	–	2.24 ha	These species may use the habitats in the study area on a continual basis or intermittently. The area of habitat to be removed would represent less than the home range of a single individual or breeding pair of any of these species.
Glossy Black-Cockatoo	V	–		
Speckled Warbler	V	–		
Varied Sittella	V	–		
Little Lorikeet	V	–	2.36 ha	
Birds – predatory birds				
Little Eagle	V	–	2.36 ha	These species are only likely to use the habitats in the study area intermittently. The area of habitat to be removed would represent less than the home range of a single individual or breeding pair of any of these species.
Square-tailed Kite	V	–		
Powerful Owl	V	–		
Invertebrates				
Cumberland Plain Land Snail	E1	–	2.73 ha	
Mammals – bats				
Large-eared Pied Bat	V	V	2.24 ha	These species may use the habitats in the study area on a continual basis or intermittently. The area of habitat to be removed would represent less than the home range of a single individual or breeding pair of any of these species.
Eastern False Pipistrelle	V	–		
Little Bent-wing Bat	V	–		
Eastern Bent-wing Bat	V	–		
Eastern Freetail Bat	V	–		
Southern Myotis	V	–		
Grey-headed Flying-fox	V	V	2.36 ha	
Yellow-bellied Sheathtail-bat	V	–	2.24 ha	
Greater Broad-nosed Bat	V	–		

(1) Vulnerable (V), Endangered (E1) as listed on the BC Act

(2) Vulnerable (V) as listed on the EPBC Act

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5.1.4 AQUATIC IMPACTS

Impacts on aquatic biodiversity are described in this section. The existing aquatic environment within the study area consists of two small tributaries which flow into South Creek. The two small tributaries are modified and degraded in nature and have heavy weed infestations in some areas. These aquatic environments provide limited value to aquatic biodiversity due to their disturbed nature and provide habitat for common aquatic fauna species that are well adapted and tolerant to disturbed environments. No threatened species, populations or ecological communities listed under the FM Act are known or likely to occur in the study area. Discussion of the potential impacts of the Proposal on the general aquatic environment of the study area is provided in Table 5.5.

Table 5.5 Impacts on aquatic biodiversity

POTENTIAL IMPACT	CONSTRUCTION	OPERATION
Reduction in water quality	Unmanaged construction activities (such as earthworks, relocation of utilities and removal of vegetation) could result in: soil erosion, siltation and off-site movement of eroded sediments by stormwater. This could contribute to increased levels of turbidity and sediment deposition, decreased dissolved oxygen, and changed pH levels in waterways. In addition, accidental fuel and chemical spills and contaminated runoff from construction vehicles, plant, equipment or chemical storage areas have the potential to reach waterbodies and streams within and adjacent to the study area.	An increase in impervious surfaces would likely result in an increased volume of runoff, which would lead to increased scouring, erosion and sedimentation. Run-off may carry increased sediment loads and nutrients (such as nitrogen and phosphorus), surrounding waterbodies and streams within and adjacent to the study area.
Changes to the geomorphology of watercourses	Temporary changes in creek flows and velocities downstream of waterbodies and creeks within the study area may occur. Implementation of sediment and erosion controls will be implemented to ensure any indirect impacts to creek flows and velocities are not significantly changed and to avoid any erosion and bed and bank stability impacts. Mobilised sediment could build up in the waterways in and downstream of the study area. Impermeable surfaces created by the Proposal would lead to increases in the volume and rate of runoff, which could cause erosion within the instream channel.	Changes to the geomorphology of watercourses from surface water runoff during operation of the Proposal is considered negligible, given that stormwater discharges would be via the stormwater network. Drainage works would be designed to prevent scouring of creeks and drainage lines.
Loss of freshwater and riparian habitat at mapped waterbodies and streams	Small areas of both mapped streams would have direct impacts, due to the removal of riparian vegetation.	All areas of retained native vegetation would be subject to vegetation management to enhance biodiversity values of adjacent stream and creeks. Indirect impacts would be managed through water sensitive urban design principles.

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5.1.5 CHANGES TO HYDROLOGY (INCLUDING EROSION AND SEDIMENTATION)

The existing hydrological conditions of the Proposal are already affected by altered landform and altered stormwater runoff and velocity as a result of surrounding land uses and existing roads. The Proposal may result in further alteration to the hydrology of the study area due to an increase in surface runoff.

The study area does not contain any native vegetation communities (e.g. natural wetlands) which are likely to be reliant on surface water. Given the already altered hydrological condition of the Proposal and the lack of natural ecosystems likely to be reliant on surface water, possible reductions in surface water accumulation because of the Proposal are unlikely to have a significant impact on native vegetation communities.

It is recommended that the stormwater design for the Proposal be done in accordance with '*Managing urban stormwater: Soils and construction, Volume 2D: Main Road Construction, Sydney'* (Blue Book) (Department of Environment & Climate Change, 2008) to avoid potential impacts to surrounding native vegetation communities.

5.1.6 INCREASE IN FAUNA INJURY AND/OR MORTALITY

Injury and mortality of fauna could occur during construction activities and during operation of the road and are discussed in Table 5.6.

Injury and mortality may occur:

- during construction when vegetation and habitat is being cleared
- when machinery and plant is moved to, from and on site
- during public use of the road during the operational phase of the Proposal.

5.1.7 WILDLIFE CONNECTIVITY AND HABITAT FRAGMENTATION

The impacts of the Proposal on wildlife habitat connectivity are discussed in this section and likely to be an impact associated with the construction of the Proposal. Habitat fragmentation is the division of a single area of habitat into two or more smaller areas, with the occurrence of a new habitat type in the area between the fragments. This new dividing habitat type is often artificial and inhospitable to the majority of species remaining within the fragments.

These newly created habitats (cleared areas or planted roadside vegetation) are also more likely to be used by species (mostly generalists) that are considered aggressive (Grey, Clarke et al. 1998) and can further impact on the population levels of the species remaining in the adjoining natural habitat fragments. In addition to the loss of habitat area, the process of fragmentation can impact on species within the newly created fragments in several ways, including barrier effects, genetic isolation, and edge effects.

Impacts of fragmentation and the affected biodiversity is outlined and discussed in Table 5.7 below.

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Table 5.6 Potential for injury and mortality of fauna as a result of the Proposal

ACTIVITY WITH POTENTIAL TO CAUSE MORTALITY	NATIVE ANIMALS WITH POTENTIAL TO BE AFFECTED	NATURE AND MAGNITUDE OF THE IMPACT OF THE PROPOSAL
Vegetation/habitat removal during construction		
Removal of mature trees with hollows and dead standing trees	— Hollow-dependent bats (including threatened species as listed in Table 4.6) — Hollow-nesting and canopy-nesting birds (including threatened species as listed in Table 4.6) — Arboreal mammals — Arboreal reptiles — Arboreal frogs.	Vegetation removal will be undertaken in accordance with Guide 4: Clearing of vegetation and removal of bushrock and Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA proposals (Roads and Traffic Authority 2011). Implementation of these guidelines will minimise fauna injury and mortality during construction but is unlikely to eliminate the potential for it to occur. Mortality of smaller species of native reptiles and frogs may be moderate. These smaller, non-threatened species are generally abundant and the mortality caused by the Proposal is unlikely to have a substantial long-term impact on populations of these species. **Threatened birds, bats, mammals and reptiles** The level of mortality and injury of both non-threatened and threatened species of birds, bats, arboreal mammals and larger reptiles is likely to be low with the implementation of the guidelines. The implementation of guidelines and mitigation measures include pre-clearance surveys and 'spotter-catchers' whilst vegetation clearance is being undertaken.
Removal of understorey, groundcover and topsoil	— Small woodland birds (species which nest in understorey vegetation and breed locally as listed in Table 4.6) — Ground-dwelling reptiles — Frogs.	
Machinery/plant and vehicle movements		
Movements of machinery/plant and vehicles between locations within the study area during construction	— Terrestrial, semi-aquatic and arboreal reptiles, frogs and mammals — Birds	Occasional mortality of native animals may occur during vehicle movements within the study area. With the implementation of speed limits and briefing of staff, the level of construction-phase mortality of native wildlife is likely to be negligible.

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ACTIVITY WITH POTENTIAL TO CAUSE MORTALITY	NATIVE ANIMALS WITH POTENTIAL TO BE AFFECTED	NATURE AND MAGNITUDE OF THE IMPACT OF THE PROPOSAL
Movements of vehicles during operation resulting in roadkill	— Terrestrial, semi-aquatic and arboreal reptiles and frogs. — Mammals (e.g. Emu, Kangaroos etc.) — Birds	All roads have potential to result in the mortality (roadkill) of native animals. The risk of roadkill is higher where roads and/or associated landscaped areas: — traverse areas of substantial animal habitat — are located near natural or artificial water bodies — contain food sources (e.g. mown grass verges, nectar-producing shrubs) which attract animals to the road edge — have high speed limits — provide poor visibility of wildlife (e.g. due to bends, crests and poor lighting). Threatened birds and bats likely to occur within the Proposal footprint are at low risk of roadkill, since majority of threatened species are mobile (fly) and generally feed high in the canopy of vegetation. However, some species such as owls and predatory birds (Raptors) would readily feed on roadkill and would be placed at some risk of road-strike mortality. While it is not possible to eliminate the risk of roadkill occurring, it is possible to minimise roadkill through consideration of the above factors in the design of roads and associated landscaping and infrastructure. It is also possible to reduce roadkill risk by encouraging animals to cross roads more safely through provision of features such as: — fencing — landscaping which encourages birds and bats to fly higher over roads.

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Table 5.7 Potential impact of the Proposal related to wildlife habitat connectivity and fragmentation

IMPACT OF FRAGMENTATION	BIODIVERSITY WITH POTENTIAL TO BE AFFECTED	NATURE AND MAGNITUDE OF THE IMPACT OF THE PROPOSAL	DURATION OF IMPACT
Genetic isolation due to fragmentation of habitat and barrier effects	Birds and bats	Birds and bats are unlikely to be genetically isolated by the Proposal due to their ability to fly over the roadway.	Permanent
	Terrestrial mammals, frogs and reptiles	While the Proposal will result in a slight increase in the distance between the habitat of populations and sub-populations of species, it is not likely to significantly alter the current extent of genetic mixing or to result in significantly increased genetic isolation.	Permanent
	Cumberland Plain Land Snail	The habitat of the Cumberland Plains Land Snail is already fragmented and isolated by existing roadway and areas of industrial development. Given the species' very limited dispersal ability (Clarke and Richardson 2002), it is likely that sub-populations would have limited interaction between one another due to current habitat fragmentation. The Proposal is considered unlikely to substantially increase the present level of fragmentation of any sub-populations. Given the limited opportunity for genetic interaction between isolated groups, the contribution of each group to the viability of nearby groups (and the broader population) also appears limited. There may however be potential for currently isolated groups to contribute to one another's viability through the possible translocation of individuals to supplement nearby groups in the locality thereby increasing the genetic diversity of the recipient groups (sub-populations).	Permanent
	Native plants	The habitat of these plants is already fragmented and isolated by Links Road and areas of industrial land and agricultural use. While the Proposal will result in a slight increase in the distance between the habitat of populations and sub-populations of these species, it is not likely to significantly alter the current extent of genetic mixing or to result in significantly increased genetic isolation.	Permanent

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IMPACT OF FRAGMENTATION	BIODIVERSITY WITH POTENTIAL TO BE AFFECTED	NATURE AND MAGNITUDE OF THE IMPACT OF THE PROPOSAL	DURATION OF IMPACT
Edge effects	Native plants (barrier effects)	Habitat/vegetation fragmentation is likely to cause the following increased edge effects associated with the interface between the road and nearby areas of habitat: — altered soil moisture conditions — altered light conditions (shading, reduced-shading, artificial lighting) — noise and vibration (construction and operation) — weed invasion (associated with soil disturbance and roadside littering). These effects of fragmentation are likely to reduce the suitability of habitat next (generally within 20 metres) to the roadway. Most the vegetation affected is already subject to such edge effects and the increase in edge effects created by the Proposal is unlikely to be significant.	Permanent

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5.1.8 POTENTIAL ENVIRONMENTAL IMPACT OF NOISE AND VIBRATION ON WILDLIFE

Substantial variation has been shown in scientific studies in the responses of wildlife to human-generated noise and vibration, ranging from serious to non-existent in different species and situations. The risk of hearing damage in wildlife is probably greater from exposure to very loud noises at close proximity than from long-term exposure to lower noise levels. The presence or otherwise of direct physiological effects of noise on wildlife is poorly known (Larkin 1996).

The main impact on wildlife associated with noise are behavioural. Vehicle noise has been shown, particularly in some species of birds and frogs, to interfere with communication essential for reproduction; however pedestrian activity may cause stronger behavioural reactions than people in vehicles. Noise may affect behaviour by causing animals to retreat from favourable habitat near noise sources, reducing time spent feeding and resulting in energy depletion and lower likelihood of survival and reproduction (Larkin 1996).

Serious effects such as decreased reproductive success have been documented in some studies and documented to be lacking in other studies on other species (Larkin 1996). Decreased responsiveness of wildlife after repeated noises is frequently observed and usually attributed to habituation (Larkin 1996).

The wildlife of the study area is likely to be habituated to frequent noise exposure from the surrounding residential properties and existing roadways around Links Road.

While the construction of the Proposal may cause temporary disturbance to animals, the impact from noise emissions are likely to be localised close to the study area (up to 100 m) and are not likely to have a significant, long-term, impact on wildlife populations.

It is likely that most animal species within the study area and surrounds are already habituated to periodic noise disturbance from human activity and road activity and are also unlikely to be significantly affected by the Proposal's operational noise.

5.1.9 WEED AND PEST INVASION

From a biodiversity conservation perspective, pest animals include all species that have a negative impact on the functioning of natural ecosystems and/or the conservation of threatened biodiversity. Pests therefore include both exotic and native species. Exotic pests present or likely to occur on within the study area include the Fox, Rabbit, Brown Hare, Cat, Common Myna, House Mouse, Black Rat and Common Starling.

These species have the potential to affect uncommon or threatened indigenous biodiversity through predation (e.g. Black Rat, Cat, Fox), grazing (e.g. Rabbit, Brown Hare) and competition for breeding habitat (e.g. Common Myna and Common Starling).

The majority of known pest species in the locality are quite mobile in nature or prolific. There is therefore little potential for the Proposal to introduce these species to any new location where it is currently absent.

The habitat that would be removed for the Proposal is already affected by pest species. Removal of this habitat would result in a reduction in habitat available to these species. In the short term this may lead to increased competition for resources (e.g. tree hollows) and increased pressure on remaining habitats.

Many highly invasive and destructive pest species which are found overseas or interstate have not yet become established or presently have restricted distributions in NSW. Several such species are the subject of Key Threatening Process listings (e.g. Red Imported Fire Ant, Yellow Crazy Ant, Large Earth Bumblebee, Cane Toad). The primary risk associated with these species is the importation of goods or materials from interstate or overseas locations where populations of these species are well established. As the Proposal does not involve importation of goods from overseas or interstate, it has low potential to bring novel species to the study area.

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5.1.10 INVASION AND SPREAD OF PATHOGENS AND DISEASE

Plant and animal pathogens can affect threatened biodiversity through direct mortality and modification to vegetation structure and composition. The following pathogens are considered to have potential to affect the biodiversity within the study area and are the subject of Key Threatening Process listings:

- Amphibian Chytrid Fungus (*Batrachochytrium dendrobatidis*)
- Exotic Rust Fungi (order *Pucciniales*, e.g. Myrtle rust fungus *Uredo rangelii*)
- Phytophthora Root Rot Fungus (*Phytophthora cinnamomi*).

These three pathogens have all been recorded in the Sydney Basin bioregion and have potential to occur on within the Proposal area at present or in the future. The main way in which Exotic Rust Fungi and Phytophthora Root Rot Fungus may be spread is through the movement of infected plant material and/or soil. The construction and operation of the Proposal may increase the risk of disturbing and spreading these pathogens. With the implementation of hygiene procedures for the use of vehicles and the importation of materials to the Proposal area, the risk of introducing these pathogens would, however, be low. Preferential use of plant materials sourced on-site (e.g. mulch, seeds) used for vegetation restoration would also help to minimise this risk.

Amphibian Chytrid Fungus can be spread through the movement of infected animals or water (including mud or moist soil) from infected areas. With the implementation of hygiene procedures for the use of vehicles and the importation of materials to the study area, the risk of introducing this pathogen to uninfected areas is low.

5.2 MITIGATION

The following general measures are recommended to ensure ecological impacts are minimised (in particular during construction):

- Implement pre-clearing protocols, including:
  - An experienced fauna ecologist will check for the presence of flora and fauna species and habitat on site before clearing begins such as the presence of bird nests.
  - Prior to construction, site personnel should be adequately informed of environmental management procedures and vegetation exclusion zones including, but not limited to, issues related to flora and fauna management, weed control, erosion and sediment control.
  - Establishment of Vegetation Exclusion Zones (as outlined in Figure 3.2) to protect vegetation, threatened flora species and fauna habitat outside of the assessed and approved clearing limits. Vegetation to be retained are to be clearly defined on ground and ‘no go zones’ clearly signposted and fenced to prevent unauthorised clearing and vehicular and/foot traffic.
- During construction, the following general measures would be implemented:
  - All workers would be provided an environmental induction prior to starting work on site. This would include information on the ecological values of the site, protection measures to be implemented to protect biodiversity, and penalties for breaches.
  - The limits of clearing would be clearly demarcated on-site (where appropriate) prior to construction to avoid unnecessary vegetation and habitat removal. This could include the installation of fencing around the Proposal footprint.
- Implement clearing and construction protocols, including:
  - Carefully clear vegetation so as not to mix topsoil with debris and to avoid impacts to surrounding native vegetation.
  - Avoid excessive soil disturbance.

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- When accessing construction sites, contractors should only use designated access tracks.
- An experienced and licensed wildlife carer and/or ecologist would be present to supervise vegetation clearing and capture and relocate fauna.

- Implement flora and fauna control measures including:
  - Salvage of dead timber from Proposal site into adjacent habitat to provide ground habitat.
  - Priority weeds within the study area would be managed in accordance with the *Biosecurity Act 2015*.
  - Weed species within the study area would be managed to control them from further spread. Management techniques may include immediate weed removal and disposal without stockpiling, disposal of weed-contaminated soils at appropriate weed disposal facilities and to ensure that all equipment is cleaned prior to and on completion of works to ensure weeds are not introduced or spread to other locations.
  - Protocols to prevent the introduction and/or spread of Chytrid fungus would be implemented. These protocols would be based on OEH Hygiene Protocol for the Control of Disease in Frogs.
- Implement operational controls protocols including:
  - Implement buffer zones around vegetation stands where possible to restrict potential operations/storage outside of Proposal site.
  - Hygiene procedures for the use of vehicles and the importation of materials to and between sites to reduce to the risk of introducing/spreading these pathogens.

5.3 SIGNIFICANCE ASSESSMENTS

Assessments of significance have been conducted for each threatened species and population recorded in the study area or considered to have a moderate to high likelihood of occurrence (see section 5). Combined assessments of significance have been conducted for groups of species that have similar life history and habitat requirements; e.g. threatened woodland birds, opportunistic blossom nomads.

Assessments of significance have been undertaken in accordance with the following published guidelines:

- Threatened species assessment guidelines – assessment of significance for BC Act listed biodiversity (Department of Environment and Climate Change, 2007b)
- Significant Impact Guidelines 1.1 – Matters of National Environmental Significance for EPBC Act listed biodiversity (Department of the Environment, 2013)
- Referral guidelines for species listed under the EPBC Act (Department of the Environment and Energy, 2017b).

Assessments of significance are provided in Appendix E with the results for Threatened Ecological Communities, Threatened Flora and Threatened Fauna summarised in Table 5.8 and

Table 5.9. Given the Proposal is not considered likely to lead to a significant impact on threatened species, populations, ecological communities or their habitats, a Species Impact Statement (SIS) is not required under the BC Act to support this Proposal. In respect to MNES matters, a referral of this Proposal for consideration as a controlled action under the EPBC Act is not required.

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Table 5.8 Summary of assessments of significance for threatened ecological communities

VEGETATION TYPE	CONDITION CLASS	THREATENED ECOLOGICAL COMMUNITY	BC ACT STATUS	EPBC ACT STATUS	PROPOSAL FOOTPRINT IMPACT	SIGNIFICANT IMPACT?
PCT 724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Shale Gravel Transition Forest in the Sydney Basin Bioregion	Endangered	Critically Endangered	0.33	No
	Poor		Endangered	The patch does not meet condition thresholds	0.49	No
PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Endangered	Not listed	1.91	No
PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered	The patch does not meet condition thresholds	0.00	No

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Table 5.9 Summary of assessments of significance for threatened flora and fauna

SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT	PROPOSAL FOOTPRINT IMPACT	SIGNIFICANT IMPACT?
FLORA					
Dillwynia tenuifolia	–	V	–	0 individuals; 0.82 ha of potential habitat (PCT 724)	No
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	V	–	652 individuals; 2.73 ha of potential habitat (PCT 724, PCT 835 and PCT 849)	No
Pultenaea parviflora	–	E1	V	30 individuals; 2.73 ha of potential habitat (PCT 724 and PCT 835)	No
FAUNA					
Birds					
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	–	2.24 ha	No
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	–	2.24 ha	No
Chthonicola sagittata (syn. Pyrrholaemus sagittatus)	Speckled Warbler	V	–	2.24 ha	No
Daphoenositta chrysoptera	Varied Sittella	V	–	2.24 ha	No
Glossopsitta pusilla	Little Lorikeet	V	–	2.36 ha	No
Hieraaetus morphnoides	Little Eagle	V	–	2.36 ha	No
Lophoictinia isura	Square-tailed Kite	V	–	2.36 ha	No
Ninox strenua	Powerful Owl	V	–	2.36 ha	No
Invertebrates					
Meridolum corneovirens	Cumberland Plain Land Snail	E	–	2.73 ha	No
Mammals					
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	2.24 ha	No
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	–		No
Miniopterus australis	Little Bent-wing Bat	V	–		No
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	–		No

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SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT	PROPOSAL FOOTPRINT IMPACT	SIGNIFICANT IMPACT?
Mormopterus (Micronomus) norfolkensis	Eastern Freetail Bat	V	–		No
Myotis macropus	Southern Myotis	V	–		No
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	2.36 ha	No
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	–	2.24 ha	No
Scoteanax rueppellii	Greater Broad-nosed Bat	V	–		No

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6 CONCLUSION

This Biodiversity Assessment has been prepared as a technical report to the Statement of Environmental Effects that would support a Development Application to Penrith City Council for the proposed upgrade and extension of Links Road. The field survey results and desktop assessments identified a number of biodiversity values within the study area:

- The presence of three threatened ecological communities:
  - Shale Gravel Transition Forest (listed as Endangered under the BC Act and Critically Endangered under the BC Act)
  - River-Flat Eucalypt Forest (listed as Endangered under the BC Act)
  - Cumberland Plain Woodland (listed as Critically Endangered under both the BC and EPBC Act).
- The presence of three threatened flora species:
  - *Dillwynia tenuifolia* (listed as Vulnerable BC Act)
  - *Grevillea juniperina subsp. juniperina* (Juniper-leaved Grevillea) (listed as Vulnerable BC Act)
  - *Pultenaea parviflora* (listed as Endangered under the BC Act and Vulnerable under the EPBC Act).
- The presence of one threatened fauna species:
  - Cumberland Plain Land Snail (*Meridolum corneovirens*) (listed as Endangered under the BC Act).

Based on the habitat characteristics of the study area, the results of field surveys and historical records, a further 17 threatened fauna species are considered to have a moderate or high likelihood of occurrence within the study area, which include:

- eight threatened bird species
- nine threatened mammal species.

Within the Proposal footprint a total of 8.71 ha of vegetation has been recorded, of which 2.73 ha is native and 5.89 is non-native vegetation. Of the vegetation to be cleared, 2.73 ha is consistent with relevant listings under the BC Act and 0.33 ha is consistent with Critically Endangered Ecological Communities listed under the EPBC Act. The clearing of threatened flora species, vegetation and loss potential habitat for threatened species is the main biodiversity impact of the Proposal.

Direct impact to native vegetation communities which provide habitat for threatened flora and fauna has been minimised through the implementation of Vegetation Exclusion Zones. Cumberland Plain Woodland falls entirely within a Vegetation Exclusion Zone and will not be directly impact whilst clearing of Shale Gravel Transition Forest has been reduced from 0.90 ha to 0.33 ha. Further, four individuals of *Pultenaea parviflora* and 141 *Grevillea juniperina subsp. juniperina* individuals have been avoided through the establishment of exclusion zones and will not be directly impacted.

Assessments of impact significance were conducted for all threatened entities considered likely to be affected by the Proposal. Through these assessments, it was concluded that the Proposal is unlikely to have a significant impact on any threatened species, populations or ecological communities.

Mitigation measures will be implemented to avoid and minimise the potential biodiversity impacts associated with construction and operation of the Proposal.

Given the Proposal is considered unlikely to lead to a significant impact on threatened species, populations, ecological communities or their habitats, a Species Impact Statement (SIS) is not required under the BC Act to support this Proposal. In respect to MNES matters, a referral of this Proposal for consideration as a controlled action under the EPBC Act is not required.

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7 LIMITATIONS

SCOPE OF SERVICES

This biodiversity assessment report has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or disturbance constraints.

RELIANCE ON DATA

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

ENVIRONMENTAL CONCLUSIONS

In accordance with the scope of services, WSP has relied upon the data and has conducted environmental field surveys in the preparation of the report. The nature and extent of survey conducted is described in the report.

Varying degrees of non-uniformity are encountered across all natural areas. Hence no sampling technique can eliminate the possibility that results are not totally representative of conditions encountered. The conclusions are based upon the data and the ecological surveys and are therefore merely indicative of the environmental condition of the study area at the time of preparing the report.

Also, it should be recognised that conditions, including the presence of threatened biodiversity, can change with time. No sampling technique can eliminate the possibility that a species is present within the Proposal footprint. For example, some flora may be present in the soil seed bank and some fauna species use habitats on a sporadic or seasonal basis and may not be present within the study area during surveys.

Within the limitations imposed by the scope of services, the surveys and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the client (and no other party). WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Except as provided below parties other than the client should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

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APPENDIX A

THREATENED FLORA LIKELIHOOD OF OCCURRENCE

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APPENDIX A THREATENED FLORA LIKELIHOOD OF OCCURRENCE

SPECIES NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT[3]	DATA SOURCE[4]	LIKELIHOOD OF OCCURRENCE
Acacia bynoeana	Bynoes Wattle	E1	V	Occurs south of Dora Creek-Morisset area to Berrima and the Illawarra region and west to the Blue Mountains. It grows mainly in heath and dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes disturbed sites such as trail margins and recently burnt areas. Typically occurs in association with *Corymbia gummifera, Eucalyptus haemastoma, E. gummifera, E. parramattensis, E. sclerophylla, Banksia serrata* and *Angophora bakeri.*	BioNet, PlantNet, PMST	Low – species occurrence is considered unlikely based on the absence of preferred soil type and associated species within the study area.
Acacia pubescens	Downy Wattle	V	V	Restricted to the Sydney Region from Bilpin to the Georges River and also at Woodford where it usually grows in open sclerophyll forest and woodland on clay soils. Typically it occurs at the intergrade between shales and sandstones in gravely soils often with ironstones.	BioNet, PMST	**Moderate** – Plant Community Types recorded within the study area (PCT 724; PCT 849) form associated habitat for this species. *Acacia pubescens* was considered a candidate species and subject to targeted surveys. No individuals were recorded during surveys.
Allocasuarina glareicola	-	E1	E	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Grows in Castlereagh woodland on lateritic soil. Found in open woodland with *Eucalyptus parramattensis, Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla* and *Melaleuca decora.* Common associated understorey species include *Melaleuca nodosa, Hakea dactyloides, Hakea sericea, Dillwynia tenuifolia, Micromyrtus minutiflora, Acacia elongata, Acacia brownei, Themeda triandra* and *Xanthorrhoea minor.*	BioNet, PlantNet, PMST	Low- Though PCT 724 forms associated habitat for this species few associated species were recorded.

Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001

Tel: +61 2 9272 5100
Fax: +61 2 9272 5101

www.wsp.com

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SPECIES NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT[3]	DATA SOURCE[4]	LIKELIHOOD OF OCCURRENCE
Cynanchum elegans	White-flowered Wax Plant	E1	E	Occurs from the Gloucester district to the Wollongong area and inland to Mt Dangar where it grows in rainforest gullies, scrub and scree slopes. This species typically occurs at the ecotone between dry subtropical forest/woodland communities.	PMST	Low – not recorded within the locality and is considered unlikely based on specific habitat requirements.
Dillwynia tenuifolia	-	V	V	Occurs on the Cumberland Plain from the Blue Mountains to Howes Valley area where it grows in dry sclerophyll woodland on sandstone, shale or laterite. Specifically, occurs within Castlereagh woodlands, particularly in shale gravel transition forest. Associated species include *Eucalyptus fibrosa, E. sclerophylla, Melaleuca decora, Daviesia ulicifolia, Dillwynia juniperina* and *Allocasuarina littoralis.*	BioNet, PlantNet	**Recorded** - This species was considered a candidate species and subject to targeted surveys. A total of nine individuals were recorded during targeted surveys.
Eucalyptus aggregata	Black Gum	V	V	The species grows in grassy woodlands on moist alluvial soils along creeks, poorly drained flats and hollows, south from Bathurst. They also occur as isolated paddock trees or population on stock reserves, only a few are within conserved land.	PMST	Low – not recorded within the locality and is considered unlikely based on specific habitat requirements.
Genoplesium baueri	Bauers Midge Orchid	V	E	Grows in dry sclerophyll forest and moss gardens over sandstone. The species has been recorded from locations between Ulladulla and Port Stephens. About half the records were made before 1960 with most of the older records being from northern Sydney suburbs. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments.	PMST	Low – not recorded within the locality and is considered unlikely based on specific habitat requirements.
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	V	-	Restricted to western Cumberland Plain, Marsden Park, Rooty Hill, Riverstone, Plumpton, Castlereagh NR, Blacktown, Penrith and north to Pitt Town, where it grows in open dry sclerophyll (eucalypt-dominated) forest or woodland, at altitudes of less than about 50 m, in sandy to clay-loam soils and red pseudo lateritic or sandy gravels. More specifically it grows in Cumberland Plain Woodland and Castlereagh Woodland, typically in moist sites, often beside creeks on acidic soils and often recorded on road verges. Restricted to red sandy to clay soils (often lateritic) on Wianamatta Shale and Tertiary Alluvium.	BioNet, PlantNet	**Recorded** - This species was considered a candidate species and subject to targeted surveys. A total of 1, 273 individuals were recorded during targeted surveys.
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V	Mainly known from the Prospect area (but now extinct there) and lower Georges River to Camden, Appin and Cordeaux Dam areas, with a disjunct populations near Putty, Cessnock and Cooranbong. Grows in heath or shrubby woodland in sandy or light clay soils usually over thin shales.	BioNet, PlantNet	Low – No available habitat recorded within the study area.

SPECIES NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT[3]	DATA SOURCE[4]	LIKELIHOOD OF OCCURRENCE
Haloragis exalata subsp. exalata	-	V	V	Found in the south coast, central coast and north west slopes botanical regions where it appears to require protected and shaded damp situations in riparian habitats.	PMST	Low – not recorded within the locality and is considered unlikely based on specific habitat requirements.
Hibbertia fumana	-	CE	-	Although originally collected by R. Brown, Caley and Sieber from sites as diverse as 'near South Head' and 'western Sydney', the only known extant population is in the Moorebank area (which could be the 'in occidental Sydney' or 'near Sydney' of either author). Currently only known from a single population at Moorebank but potentially elsewhere in greater Sydney. Generally found in areas of woodland with a more open understorey, in a long intergrade between Castlereagh Scribbly Gum Woodland and Castlereagh Ironbark Forest at the Moorebank Site.	-	**Moderate** –Associated habitat (PCT 724) and alluvial habitats rich in laterites were recorded within the study area. This species was considered a candidate species and subject to targeted surveys during the survey period. No individuals were recorded.
Marsdenia viridiflora subsp. viridiflora	Native Pear	E2		Occurs in subcoastal and southern Queensland but rarely in NSW with a disjunct occurrence near Sydney. It occurs as scattered plants in remnant woodland and scrub. Grows in vine thickets and open shale woodland.	BioNet	Low –Considered unlikely based on specific habitat requirements.
Micromyrtus minutiflora	-	E1	V	Occurs in the western part of the Cumberland Plain between Richmond and Penrith where it grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments.	BioNet, PlantNet, PMST	**Moderate** - Associated habitat (PCT 724) was recorded within the study area. This species was considered a candidate species and subject to targeted surveys during the survey period. No individuals were recorded.
Persoonia hirsuta	Hairy Geebung	E1	E	The species is distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. It has a large area of occurrence, but occurs in small populations. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone or very rarely on shale. Often occurs in areas with clay influence, in the ecotone between shale and sandstone.	PMST	Low – not recorded within the locality and is considered unlikely based on specific habitat requirements.

SPECIES NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT[3]	DATA SOURCE[4]	LIKELIHOOD OF OCCURRENCE
Persoonia nutans	Nodding Geebung	E1	E	Confined to the Cumberland Plain where it grows in Castlereagh Scribbly Gum Woodlands and Agnes Banks Woodlands.	BioNet, PlantNet, PMST	Low – Associated habitat in the form of PCT 724 was recorded within the study area. This species was considered a candidate species and subject to targeted surveys. No individuals were recorded.
Pimelea curviflora var. curviflora	-	V	V	Confined to coastal areas around Sydney where it grows on sandstone and laterite soils. It is found between South Maroota, Cowan, Narrabeen, Allambie Heights, Northmead and Kellyville, but its former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Usually occurs in woodland in the transition between shale and sandstone, often on Lucas Heights soil landscape.	PlantNet, PMST	Low – not recorded within the locality and is considered unlikely based on specific habitat requirements.
Pimelea spicata	Spiked Rice-flower	E1	E	This species occurs in two disjunct areas: in coastal districts from Lansdowne to Shellharbour, and in Cumberland Plain Woodland inland to Penrith. In western Sydney it grows on Wianamatta Shales in Greybox - Ironbark Woodland with *Bursaria spinosa* and *Themeda triandra*. In the Illawarra, it occurs on well structured clay soils in grassland or open woodland.	BioNet, PlantNet, PMST	**Moderate** – associated habitat in the form of PCT 849 was recorded within the study area. Due to the degraded condition of the understorey this vegetation is unlikely to provide suitable habitat.
Pomaderris brunnea	-	V	V	Confined to the Colo and Upper Nepean Rivers where it grows in open forest; in western Sydney (Camden to Picton area) known from sandy alluvium on levee and creek banks.	PMST	Low – not recorded within the locality and is considered unlikely based on specific habitat requirements.
Pterostylis gibbosa	-	E1	E	Occurs in the southern part of the Central Coast region with a disjunct population in the Hunter Valley. Grows among grass in sclerophyll forest. In the Illawarra it grows in Coastal Grassy Red Gum Forest and in Lowland Woolybutt-Melaleuca forest.	PMST	Low – not recorded within the locality and is considered unlikely based on specific habitat requirements.

SPECIES NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT[3]	DATA SOURCE[4]	LIKELIHOOD OF OCCURRENCE
Pterostylis saxicola	Sydney Plains Greenhood	E1	E	Known now only from Freemans Reach to Picton district. Grows in Sydney Sandstone Gully Forest in shallow or skeletal soils over sandstone shelves, often near streams.	PMST	Low – not recorded within the locality and is considered unlikely based on specific habitat requirements.
Pultenaea parviflora	-	E1	V	Restricted to the Cumberland Plain where it grows in dry sclerophyll forest on Wianamatta shale, laterite or alluvium. Locally abundant within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. Also occurs in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	BioNet, PlantNet, PMST	**Recorded** - This species was considered a candidate species and subject to targeted surveys. A total of 45 individuals were recorded during targeted surveys.
Rhizanthella slateri	Eastern Australian Underground Orchid	V	E	Highly cryptic as only the flowers may occur above ground. It is more frequent in areas of soil disturbance, but further habitat characteristics or associated vegetation types are poorly known, possibly occurring in sclerophyll forests.	PMST	Low – not recorded within the locality and is considered unlikely based on specific habitat requirements.
Syzygium paniculatum	Magenta Lilly Pilly	E1	V	Occurs between Bulahdelah and St Georges Basin where it grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	PMST	Low – not recorded within the locality and is considered unlikely based on specific habitat requirements.
Thesium australe	Austral Toadflax	V	V	Grows in grassland or woodland often in damp sites. It is a semi-parasitic herb and hosts are likely to be *Themeda triandra* and *Poa spp.*	PMST	Low – not recorded within the locality and is considered unlikely based on specific habitat requirements.

1. Listed under the *NSW Biodiversity Conservation Act 2016* – CE = Critically Endangered, E1= Endangered, E2= Endangered Population, V= Vulnerable
2. Listed under the Commonwealth Environment Protection and Biodiversity Act 1999 - CE = Critically Endangered, E= Endangered, V= Vulnerable
3. Habitat descriptions sourced from OEH BioNet database and Scientific Determinations for each species.
4. **BioNet**= OEH BioNet Atlas of NSW Wildlife; **PMST=** Department of Environment and Energy's EPBC Protected Matters Search Tool; **PlantNet**= NSW Flora Online Spatial search

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APPENDIX B

THREATENED FAUNA LIKELIHOOD OF OCCURRENCE

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APPENDIX B THREATENED FLORA LIKELIHOOD OF OCCURRENCE

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Amphibians (2)						
Heleioporus australiacus	Giant Burrowing Frog	V	V	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Breeding habitat of this species is generally soaks or pools within first or second order streams. Species is dependent on hanging swamps on the top of sandstone plateaus and deeply dissected gullies that occur as erosion features in the Sydney Basin.	PMST	Low - no suitable habitat identified within study area
Litoria aurea	Green and Golden Bell Frog	E1	V	Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha spp.)* or spikerushes (*Eleocharis spp.*). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available.	Bionet, PMST	Low - marginal habitat identified within study area. Habitat highly disturbed with presence of Plague Minnow. Records in locality associated with Ropes Creek, records >5 years old.
Birds (38)						

Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001

Tel: +61 2 9272 5100
Fax: +61 2 9272 5101

www.wsp.com

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SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Actitis hypoleucos	Common Sandpiper		M; Ma	The Common Sandpiper frequents a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity. It is mostly encountered along muddy margins or rocky shores and rarely on mudflats. It has been recorded in estuaries and deltas of streams, banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags. Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks.	PMST	Low – no suitable habitat identified within study area
Anthochaera phrygia (syn. Xanthomyza phrygia)	Regent Honeyeater	CE	EM	Inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. It inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. It feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany.	Bionet, PMST	Low - Marginal foraging habitat available. Rare occurrences under suitable seasonal conditions cannot be discounted. The last record within the locality is over 25 years old.
Apus pacificus	Fork-tailed Swift		M; Ma	Breeds in the northern hemisphere, wintering south to Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground. It mostly occurs over inland plains but sometimes above foothills or in coastal areas over cliffs, beaches, islands and well out to sea. It also occurs over towns and cities. It mostly occurs over dry and/or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh, grassland, spinifex sandplains, farmland and sand-dunes. It sometimes occurs above forests. It probably roosts aerially, but has occasionally been observed to land.	PMST	Low – although species may use aerial spaces above subject site is unlikely to occur within terrestrial vegetation within the subject site.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Ardea (Bulbulcus) ibis	Cattle Egret		Ma	Widespread and common according to migration movements and breeding localities surveys. Breeds in colonies, either mono-specific or with other Egrets/Herons. In Australia the principal breeding sites are the central east coast from about Newcastle to Bundaberg. It also breeds in major inland wetlands in north NSW (notably the Macquarie Marshes). Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It has been recorded on earthen dam walls and ploughed fields. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer. The Cattle Egret is known to follow earth-moving machinery and has been located at rubbish tips. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. They have sometimes been observed in swamps with tall emergent vegetation.	Bionet, PMST	**Moderate –** potential foraging habitat within study area.
Ardea alba (syn. Ardea modesta)	Eastern Great Egret		Ma	Eastern Great Egrets are widespread in Australia. They occur in all states/territories of mainland Australia and in Tasmania. In Australia, the largest breeding colonies, and greatest concentrations of breeding colonies, are located in near-coastal regions of the Top End of the Northern Territory. The Channel Country of south-western Queensland and north-eastern South Australia have at least 12 breeding colonies, and colonies are also known in the Darling Riverine Plains region of NSW and the Riverina region of NSW and Victoria. Minor breeding sites are widely scattered across the species' distribution and include sites in western Cape York Peninsula, the central coast of Queensland, north and north-eastern NSW, south-eastern South Australia, south-western Western Australia, the Kimberley region of Western Australia and the Barkly Tablelands in the Northern Territory. Non-breeding birds have been recorded across much of Australia, but avoid the driest regions of the western and central deserts. The Eastern Great Egret inhabits a wide range of wetland habitats which include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs.	PMST	Low – preferred habitat not identified within study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V		Dusky woodswallows are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.	Bionet	**Moderate** – potential foraging habitat identified within study area.
Botaurus poiciloptilus	Australasian Bittern	E1	E	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha spp.)* and spikerushes (*Eleocharis spp.).* Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds.	PMST	Low – no suitable habitat identified within study area
Calidris acuminata	Sharp-tailed Sandpiper		M; Ma	Occurs in a variety of habitats: tidal mudflat, mangrove swamps, saltmarshes, shallow fresh, brackish, salt inland swamps and lakes; flooded and irrigated paddocks, sewage farms and commercial saltfields.	PMST	Low – no suitable habitat identified within study area
Calidris ferruginea	Curlew Sandpiper	E1	M; Ma	Occurs in inter-tidal mudflats of estuaries, lagoons, mangrove channels and also around lakes, dams, floodwaters and flooded saltbush surrounding inland lakes.	PMST	Low – no suitable habitat identified within study area
Calidris melanotos	Pectoral Sandpiper		M; Ma	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species frequents coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. It is usually found in coastal or near coastal habitat but occasionally further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. It has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands.	PMST	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, *Allocasuaraina diminuta*, and *A. gymnathera.* Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (*Casuarina cristata*). Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites.	Bionet	**Moderate** – potential foraging habitat within study area.
Chrysococcyx osculans	Black-eared Cuckoo		Ma	Mainly open vegetation associations, especially open woodlands and open shrublands. Often in open woodlands dominated by Eucalyptus, particularly stunted mallee communities; Open woodlands of River Red Gum or Coolibah along rivers or round other wetlands in otherwise open grasslands; or open acacia woodlands, dominated by Mulga, Myall or Boree. Also often in saltbush or bluebush shrubland on sandhills or sandy flats; and in heathland, spinifex grassland or samphire Shrubland.	PMST	Low – preferred habitat not identified within study area.
Chthonicola sagittata (syn. Pyrrholaemus sagittatus)	Speckled Warbler	V		The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100ha survive. Lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees.	Bionet	**Moderate** – potential foraging habitat within study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Cuculus opatus (syn. Cuculus saturatus)	Oriental Cuckoo, Himalayan Cuckoo		M	A non-breeding migrant to Australia, it often inhabits rainforest, vine thickets, wet sclerophyll forest and open woodland and sometimes occurs in mangroves, wooded swamps and as vagrants in gardens. The population trend appears to be stable.	PMST	Low – preferred habitat not identified within study area. Rare occurrences during seasonal movements cannot be discounted.
Daphoenositta chrysoptera	Varied Sittella	V		The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.	Bionet	**Moderate** – potential foraging habitat within study area.
Ephippiorhynchus asiaticus	Black-necked Stork	E1		Widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Since 1995, breeding has been recorded as far south as Buladelah. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to their diet, but they feed on a wide variety of animals, including other fish, frogs and invertebrates (such as beetles, grasshoppers, crickets and crayfish).	Bionet	Low – no suitable habitat identified within study area
Gallinago hardwickii	Latham's Snipe		M; Ma	Occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed.	Bionet, PMST	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Glossopsitta pusilla	Little Lorikeet	V		The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs. Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards.	Bionet	**Moderate** – potential foraging habitat within study area.
Grantiella picta	Painted Honeyeater	V	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema.	PMST	Low – marginal habitat within study area. Preferred habitat with presence abundance of mistletoes not identified within study area.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	Ma	The White-bellied Sea-eagle is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin. In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways. Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion.	PMST	Low – marginal habitat available in study area

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Hieraaetus morphnoides	Little Eagle	V		The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.	Bionet	**Moderate** – potential foraging habitat available in study area
Hirundapus caudacutus	White-throated Needletail		M; Ma	Widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains. It is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Because they are aerial, it has been stated that conventional habitat descriptions are inapplicable, but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps. When flying above farmland, they are more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks. In coastal areas, they are sometimes seen flying over sandy beaches or mudflats and often around coastal cliffs and other areas with prominent updraughts, such as ridges and sand-dunes.	PMST	Low – although species may use aerial spaces above study area, however, it is unlikely to occur within terrestrial vegetation within the study area.
Ixobrychus flavicollis	Black Bittern	V		The Black Bittern has a wide distribution, from southern NSW north to Cape York and along the north coast to the Kimberley region. The species also occurs in the south-west of Western Australia. In NSW, records of the species are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. Feeds on frogs, reptiles, fish and invertebrates, including snails, dragonflies, shrimps and crayfish, with most feeding done at dusk and at night. During the day, roosts in trees or on the ground amongst dense reeds.	Bionet	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Lathamus discolor	Swift Parrot	E1	CE; Ma	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*) and White Box (*E. albens*). Commonly used lerp infested trees include Inland Grey Box (E. macrocarpa), Grey Box (*E. moluccana*) and Blackbutt (*E. pilularis*).	Bionet, PMST	Low – marginal foraging habitat within study area. May irregularly occur during seasonal movements. Prefers areas with larger extent/abundance of food resources (i.e. blossom resources or lerp infestations).
Lophoictinia isura	Square-tailed Kite	V		The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage.	Bionet	**Moderate** – potential foraging habitat within study area.
Melithreptus gularis gularis	Black-chinned Honeyeater	V		The eastern subspecies extends south from central Queensland, through NSW, Victoria into south eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	Bionet	Low – marginal habitat identified within study area. Preferred habitat not identified in study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Merops ornatus	Rainbow Bee-eater		Ma	Usually occur in open or lightly timbered areas, often near water. Breed in open areas with friable, often sandy soil, good visibility, convenient perches and often near wetlands. Nests in embankments including creeks, rivers and sand dunes. Insectivorous, most foraging is aerial, in clearings.	PMST	Low – no suitable habitat identified within study area
Monarcha melanopsis	Black-faced Monarch		M; Ma	Occurs in rainforests, eucalypt woodlands, coastal scrubs, damp gullies in rainforest, eucalypt forest and in more open woodland when migrating.	PMST	Low – no suitable habitat identified within study area
Motacilla flava	Yellow Wagtail		M; Ma	This species occurs in a range of habitats including estuarine habitats such as sand dunes, mangrove forests and coastal saltmarshes. This species also occurs in open grassy areas including disturbed sites such as sports grounds and has been recorded on the edges of wetlands, swamps, lakes and farm dams. This species migrates from Asia to Australia in spring-summer. It has been recorded in the estuarine areas of the Hunter River in Newcastle NSW and in QLD and the north of NT and WA.	PMST	Low – no suitable habitat identified within study area
Myiagra cyanoleuca	Satin Flycatcher		M; Ma	Widespread in eastern Australia. In Queensland, it is widespread but scattered in the east. In NSW, they are widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains. In Victoria, the species is widespread in the south and east, in the area south of a line joining Numurkah, Maldon, the northern Grampians, Balmoral and Nelson. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses. They generally occur in moister, taller forests, often occurring in gullies. They also occur in eucalypt woodlands with open understorey and grass ground cover, and are generally absent from rainforest. In south-eastern Australia, they occur at elevations of up to 1400 m above sea level, and in the ACT, they occur mainly between 800 m above sea level and the treeline.	PMST	Low – marginal habitat available in study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Ninox strenua	Powerful Owl	V		The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations. It inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. It requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider.	Bionet	**Moderate** – potential foraging habitat available in study area. Recent records within locality.
Numenius madagascariensis	Eastern Curlew		CEM; Ma	Inhabits coastal estuaries, mangroves, mud flats and sand pits. It is a migratory shorebird which generally inhabits sea and lake shore mud flats, deltas and similar areas, where it forages for crabs and other crustaceans, clam worms and other annelids, molluscs, insects and other invertebrates. Its migration route ranges from its wintering grounds in Australia to its breeding grounds in northern China, Korea and Russia.	PMST	Low – no suitable habitat identified within study area
Pandion cristatus (syn. P. haliaetus)	Eastern Osprey	V	M; Ma	Eastern Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	PMST	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Petroica boodang	Scarlet Robin	V		The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. The Scarlet Robin breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude.	Bionet	Low – marginal habitat within study area. Irregular occurrences during seasonal movements cannot be discounted.
Rhipidura rufifrons	Rufous Fantail		M; Ma	Occurs in a range of habitats including the undergrowth of rainforests/wetter eucalypt forests/gullies, monsoon forests paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, parks and gardens. When migrating they may also be recorded on farms, streets and buildings. Migrates to SE Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range.	PMST	**Moderate** – potential foraging within study area. May occur during seasonal movements.
Rostratula australis (syn. R. benghalensis)	Australian Painted Snipe (Painted Snipe)	E1	VM; Ma	The Australian Painted Snipe is restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	PMST	Low – no suitable habitat identified within study area
Tringa nebularia	Common Greenshank		M; Ma	Occurs in a range of inland and coastal environments. Inland, it occurs in both permanent and temporary wetlands, billabongs, swamps, lakes floodplains, sewage farms, saltworks ponds, flooded irrigated crops. On the coast, it occurs in sheltered estuaries and bays with extensive mudflats, mangrove swamps, muddy shallows of harbours and lagoons, occasionally rocky tidal ledges. It generally prefers wet and flooded mud and clay rather than sand.	PMST	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Tyto tenebricosa	Sooty Owl	V		Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Territories are occupied permanently. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (*Pseudocheirus peregrinus*) or Sugar Glider (*Petaurus breviceps*). Nests in very large tree-hollows.	Bionet	Low – marginal foraging habitat within study area. Preferred habitat not identified within study area.
Fish (3)						
Maccullochella peelii	Murray Cod		V	The Murray Cod was historically distributed throughout the Murray-Darling Basin (the Basin), which extends from southern Queensland, through New South Wales (NSW), the Australian Capital Territory (ACT) and Victoria to South Australia, with the exception of the upper reaches of some tributaries. The species still occurs in most parts of this natural distribution, up to approximately 1000 m above sea level. It utilises a diverse range of habitats from clear rocky streams, such as those found in the upper western slopes of NSW (including the ACT), to slow-flowing, turbid lowland rivers and billabongs. Preferred microhabitat consists of complex structural features in streams such as large rocks, snags (pieces of large submerged woody debris), overhanging stream banks and vegetation, tree stumps, logs, branches and other woody structures.	PMST	Low – no suitable habitat identified within study area
Macquaria australasica	Macquarie Perch		E	Macquarie Perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury/Nepean and Shoalhaven catchments. Macquarie Perch are found in both river and lake habitats; especially the upper reaches of rivers and their tributaries. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks. Spawning occurs just above riffles (shallow running water).	PMST	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Prototroctes maraena	Australian Grayling		V	Occurs in streams and rivers on the eastern and southern flanks of the Great Dividing Range, from Sydney, southwards to the Otway Ranges of Victoria and in Tasmania. The species is found in fresh and brackish waters of coastal lagoons, from Shoalhaven River in NSW to Ewan Ponds in South Australia. The Australian Grayling is diadromous, spending part of its lifecycle in freshwater and at least part of the larval and/or juvenile stages in coastal seas. Adults (including pre spawning and spawning adults) inhabit cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones such as the Tambo River, which is also known to have granite outcrops. The species has also been associated with clear, gravel-bottomed habitats in the Mitchell and Wonnangatta Rivers (Victoria) and in a muddy-bottomed, heavily silted habitat in the Tarwin River (Victoria). The species has been found over 100 km upstream from the sea.	PMST	Low – no suitable habitat identified within study area
Invertebrates (1)						
Meridolum corneovirens	Cumberland Plain Land Snail	E1		Lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. known from over 100 different locations, but not all are currently occupied, and they are usually isolated from each other as a result of land use patterns. Primarily inhabits Cumberland Plain Woodland (a critically endangered ecological community). This community is a grassy, open woodland with occasional dense patches of shrubs. It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest, which are also listed communities. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	Bionet	**Recorded** – habitat available in study areas where understorey microhabitat (fallen timber & leaf litter) is present. Numerous recent records within locality.
Mammals (15)						

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies.	PMST	**Moderate** – foraging habitat identified within study area.
Dasyurus maculatus maculatus	Spotted-Tailed Quoll	V	E	Found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines.	Bionet, PMST	Low – no suitable habitat identified within study area
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	Bionet	**Moderate** – foraging and potential roosting habitat identified within study area.
Miniopterus australis	Little Bent-wing Bat	V		Found along east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. Only five nursery sites /maternity colonies are known in Australia.	Bionet	**Moderate** – foraging habitat identified within study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V		Eastern Bentwing-bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Populations disperse within about 300 km range of maternity caves. Hunt in forested areas, catching moths and other flying insects above the tree tops.	Bionet	**Moderate** – foraging habitat identified within study area.
Mormopterus (Micronomus) norfolkensis	Eastern Freetail Bat	V		The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	Bionet	**High** – foraging and potential roosting habitat identified within study area.
Myotis macropus	Southern Myotis, Large-footed Myotis	V		The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	Bionet	**Moderate** – previously recorded adjacent to study area in association with South Creek tributaries and adjacent waterbodies.
Petauroides volans	Greater Glider		V	The Greater Glider has a restricted distribution in eastern Australia, from the Windsor Tableland in north Queensland to central Victoria, with an elevated range from sea level to 1200m above sea level. The species is largely restricted to eucalypt forests and woodlands, feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. It is found in abundance in montane eucalypt forest with relatively old trees and an abundance of hollows. It also favours forests with a diversity of eucalypts to cater for seasonal variation in food abundance.	PMST	Low – no suitable habitat identified within study area
Petaurus norfolcensis	Squirrel Glider	V		The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	Bionet	Low – marginal suitable habitat identified within study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	V	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. However the distribution of the species across its original range has declined significantly in the west and south and has become more fragmented. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. Highly territorial and have strong site fidelity with an average home range size of about 15 ha.	PMST	Low – no suitable habitat identified within study area
Phascolarctos cinereus	Koala	V	V	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. It was briefly historically abundant in the 1890s in the Bega District on the south coast of NSW, although not elsewhere, but it now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Some preferred species include Forest Red Gum, Grey Gum. In coastal areas, Tallowwood and Swamp Mahogany are important food species, while in inland areas White Box, Bimble Box and River Red Gum are favoured. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	Bionet, PMST	Low – marginal habitat available. Presence of some food trees, however, study area is fragmented and disturbed. No records within proximity to study area.
Pseudomys novaehollandiae	New Holland Mouse		V	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Genetic evidence indicates that the New Holland Mouse once formed a single continuous population on mainland Australia and the distribution of recent subfossils further suggest that the species has undergone a large range contraction since European settlement. Total population size of mature individuals is now estimated to be less than 10,000 individuals although, given the number of sites from which the species is known to have disappeared between 1999 and 2009, it is likely that the species' distribution is actually smaller than current estimates. Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes.	PMST	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Grey-headed Flying-foxes are generally found within 200km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Can travel up to 50km from the camp to forage; commuting distances are more often <20km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.	Bionet, PMST	**High** – foraging habitat identified within study area.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Bionet	**Moderate** – foraging and potential roosting habitat identified within study area.
Scoteanax rueppellii	Greater Broad-nosed Bat	V		The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500m. Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3-6m.	Bionet	**Moderate** – foraging and potential roosting habitat identified within study area.

1. Listed under the NSW Biodiversity Conservation Act 2016 – CE = Critically Endangered, E1= Endangered, E2= Endangered Population, V= Vulnerable
2. Listed under the Commonwealth Environment Protection and Biodiversity Act 1999 - CE = Critically Endangered, E= Endangered, V= Vulnerable, M= Migratory, Ma=Marine
3. **BAM =** BAM Assessment Calculator**; BioNet** = OEH BioNet Atlas of NSW Wildlife; **PMST =** Department of Environment and Energy's EPBC Protected Matters Search Tool

APPENDIX C

BAM PLOT DATA

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

APPENDIX A BAM PLOT DATA

Date: 15/8/18			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat
Q1: PCT 724 Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion (Moderate Condition)			# spp	Count	Count	Count	Count	Count	Count	Count	Count	Count
Sheet version: 20180807			48	34	4	8	13	4	0	5	14	8
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum
			106	83.2	38	28.6	14.5	1.5	0	0.6	22.8	21.6
Acacia binervia	7	10	TG		7							
Acacia falcata	0.1	1	SG			0.1						
Allocasuarina littoralis	12	20	TG		12							
*Andropogon virginicus**	0.4	10	HT									0.4
Angophora floribunda	10	15	TG		10							
*Araujia sericifera**	0.1	1	HT									0.1
Aristida ramosa	3	100	GG				3					
Aristida vagans	0.8	40	GG				0.8					
*Asparagus aethiopicus**	0.1	3	HT									0.1
*Asparagus asparagoides**	0.2	5	HT									0.2
Boronia polygalifolia	0.1	3	FG					0.1				
Brunoniella australis	0.5	30	FG					0.5				
Bursaria spinosa subsp. spinosa	4	30	SG			4						
Clematis glycinoides var. glycinoides	0.2	5	OG							0.2		
*Conyza bonariensis**	0.1	1	EX								0.1	
*Cotoneaster spp.**	0.2	1	HT									0.2
Cymbopogon refractus	2	70	GG				2					
Daviesia ulicifolia	8	20	SG			8						
Desmodium varians	0.1	3	OG							0.1		
Dichelachne micrantha	0.8	30	GG				0.8					
Dichondra repens	0.8	60	FG					0.8				
Dillwynia sieberi	4	15	SG			4						
Entolasia stricta	0.4	20	GG				0.4					
Eragrostis brownii	0.4	20	GG				0.4					
*Eragrostis curvula**	20	200	HT									20
Eragrostis leptostachya	1	40	GG				1					
Eucalyptus tereticornis	9	4	TG		9							
Glycine clandestina	0.1	3	OG							0.1		
Glycine tabacina	0.1	8	OG							0.1		
*Gomphocarpus fruticosus**	0.1	1	EX								0.1	
Grevillea juniperina subsp. juniperina	10	30	SG			10						
Hardenbergia violacea	0.1	2	OG							0.1		
*Ligustrum lucidum**	0.4	2	HT									0.4
*Ligustrum sinense**	0.2	1	HT									0.2

Easting	293170
Northing	6263738
Orientation	130
Plot size	20 x 20
BAM Attributes 20x50m plot	
Stem classes	
80+	0
50-79	1
30-49	Yes
20-29	Yes
10-19	Yes
5-9	Yes
<5	No
Hollows	0
Length logs (m)	37
BAM Attributes 1x1 plot (%)	
Litter (%)	52

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Q1 continued.

*Ligustrum sinense**	0.2	1	HT									0.2				
Lissanthe strigosa	1	8	SG			1										
Lomandra confertifolia subsp. rubiginosa	2	80	GG				2									
Lomandra filiformis subsp. coriacea	0.4	10	GG				0.4									
Lomandra filiformis subsp. filiformis	0.1	10	GG				0.1									
Lomandra multiflora subsp. multiflora	0.6	10	GG				0.6									
Microlaena stipoides var. stipoides	2	50	GG				2									
Ozothamnus diosmifolius	0.5	7	SG			0.5										
Paspalidium distans	1	50	GG				1									
*Pavonia hastata**	0.6	40	EX								0.6					
*Plantago lanceolata**	0.1	2	EX								0.1					
Pultenaea parviflora	1	7	SG			1										
*Setaria parviflora**	0.1	5	EX								0.1					
Stackhousia viminea	0.1	2	FG					0.1								
*Yucca aloifolia**	0.2	5	EX								0.2					

Date: 12/9/18			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat
Q3: PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (Moderate Condition)			# spp	Count	Count	Count	Count	Count	Count	Count	Count	Count
Sheet version: 20170224.1531			29	9	1	1	3	2	0	2	20	10
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum
			181.5	56.4	35	1	20	0.2	0	0.2	125.1	120.5
Angophora floribunda	35	10	TG		35							
*Araujia sericifera**	0.4	5	HT									0.4
Aristida ramosa	2	20	GG				2					
*Asparagus asparagoides**	0.8	30	HT									0.8
*Asparagus officinalis**	0.2	5	EX								0.2	
Cenchrus ciliaris	0.3	10	HT									0.3
Centella asiatica	0.1	20	FG					0.1				
*Chloris gayana**	5	20	HT									5
*Cirsium vulgare**	0.1	1	EX								0.1	
*Cortaderia selloana**	1	1	HT									1
*Cotoneaster glaucophyllus**	1	1	EX								1	
Cynodon dactylon	10	100	GG				10					
Dianella longifolia var. longifolia	0.1	1	FG					0.1				
*Eragrostis curvula**	1	5	HT									1
Glycine tabacina	0.1	5	OG							0.1		
*Gomphocarpus fruticosus**	0.1	1	EX								0.1	
Grevillea juniperina subsp. juniperina	1	4	SG			1						
Hardenbergia violacea	0.1	1	OG							0.1		
*Ligustrum lucidum**	35	100	HT									35
*Ligustrum sinense**	2	10	HT									2
Microlaena stipoides var. stipoides	8	80	GG				8					
*Nerium oleander**	0.1	1	EX								0.1	
*Paspalum dilatatum**	25	100	HT									25
*Pavonia hastata**	2	40	EX								2	
*Plantago lanceolata**	0.4	20	EX								0.4	
*Rubus fruticosus agg.**	50	40	HT									50
*Sida rhombifolia**	0.3	20	EX								0.3	
*Verbena bonariensis**	0.3	15	EX								0.3	
*Vicia sativa subsp. sativa**	0.1	20	EX								0.1	

Easting	292927
Northing	6263798
Orientation	130
Plot size	20 x 20
Attributes 20x50m plot	
Stem classes	
80+	0
50-79	0
30-49	Yes
20-29	Yes
10-19	Yes
5-9	No
<5	Yes
Hollows	0
Length logs (m)	3
Attributes 1x1 plot (%)	
Litter (%)	44

Document Set ID: 8477747
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Date: 12/9/18			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat
Q4: PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (Moderate Condition)			# spp	Count	Count	Count	Count	Count	Count	Count	Count	Count
Sheet version: 20170224.1531			32	21	2	5	9	2	0	3	11	8
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum
			122.3	61.6	35.4	12.1	10	0.6	0	3.5	60.7	54.7
Acacia falcata	5	40	SG			5						
Acacia parramattensis	0.4	1	TG		0.4							
Angophora floribunda	35	50	TG		35							
*Araujia sericifera**	0.8	30	HT									0.8
Aristida ramosa	2	80	GG				2					
Aristida vagans	0.1	5	GG				0.1					
*Asparagus aethiopicus**	0.1	1	HT									0.1
*Asparagus asparagoides**	0.7	20	HT									0.7
Bursaria spinosa subsp. spinosa	1	5	SG			1						
Carex inversa	1	40	GG				1					
*Chloris gayana**	3	50	HT									3
Cynodon dactylon	1	49	GG				1					
Cyperus gracilis	0.8	20	GG				0.8					
Daviesia ulicifolia	4	30	SG			4						
Desmodium varians	0.1	4	OG							0.1		
Dianella longifolia var. longifolia	0.5	10	FG					0.5				
Dichelachne micrantha	1	50	GG				1					
Dichondra repens	0.1	5	FG					0.1				
*Eragrostis curvula**	45	500	HT									45
Glycine clandestina	0.4	20	OG							0.4		
Grevillea juniperina subsp. juniperina	2	12	SG			2						
Hardenbergia violacea	3	80	OG							3		
Hibbertia pedunculata	0.1	5	SG			0.1						
*Ligustrum lucidum**	4	10	HT									4
*Ligustrum sinense**	1	10	HT									1
Lomandra filiformis subsp. filiformis	0.1	5	GG				0.1					
Microlaena stipoides var. stipoides	3	100	GG				3					
Paspalidium distans	1	50	GG				1					
*Pavonia hastata**	5	100	EX								5	
*Rubus fruticosus**	0.1	2	HT									0.1
*Sida rhombifolia**	0.6	30	EX								0.6	
*Verbena rigida**	0.4	10	EX								0.4	

Easting	292921
Northing	6263831
Orientation	120
Plot size	20 x 20
Attributes 20x50m plot	
Stem classes	
80+	0
50-79	0
30-49	Yes
20-29	Yes
10-19	Yes
5-9	Yes
<5	Yes
Hollows	0
Length logs (m)	2
Attributes 1x1 plot (%)	
Litter (%)	68

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Date: 17/9/18			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat
Q5: PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (Moderate Condition)			# spp	Count	Count	Count	Count	Count	Count	Count	Count	Count
Sheet version: 20170224.1531			40	18	2	3	3	5	1	4	22	10
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum
			106.4	28.7	7	11.1	4.9	4	0.6	1.1	77.7	71.1
Acacia falcata	10	50	SG			10						
*Araujia sericifera**	0.4	3	HT									0.4
Aristida ramosa	0.3	10	GG				0.3					
*Asparagus aethiopicus**	0.1	5	HT									0.1
*Asparagus asparagoides**	0.2	1	HT									0.2
Asperula conferta	0.5	20	FG					0.5				
*Aster subulatus**	0.1	3	EX								0.1	
*Bidens pilosa**	0.1	10	EX								0.1	
*Brassica rapa**	0.3	50	EX								0.3	
Bursaria spinosa subsp. spinosa	0.1	1	SG			0.1						
*Cenchrus clandestinus**	2	40	EX								2	
Centella asiatica	2	100	FG					2				
Cheilanthes sieberi subsp. sieberi	0.6	40	EG						0.6			
Convolvulus erubescens	0.2	3	OG							0.2		
*Conyza bonariensis**	1	30	EX								1	
Cymbopogon refractus	0.6	30	GG				0.6					
Cynodon dactylon	4	100	GG				4					
*Cyperus eragrostis**	0.1	1	HT									0.1
Dianella longifolia var. longifolia	0.8	20	FG					0.8				
Einadia hastata	0.6	10	FG					0.6				
Einadia nutans subsp. linifolia	0.1	10	FG					0.1				
*Eragrostis curvula**	55	500	HT									55
Eucalyptus amplifolia subsp. amplifolia	2	20	TG		2							
Eucalyptus tereticornis	5	8	TG		5							
Glycine clandestina	0.4	10	OG							0.4		
Glycine tabacina	0.1	5	OG							0.1		
*Gomphocarpus fruticosus**	0.7	10	EX								0.7	
Hardenbergia violacea	0.4	5	OG							0.4		
*Lavandula stoechas**	0.1	1	EX								0.1	
*Ligustrum lucidum**	5	10	HT									5
*Ligustrum sinense**	1	1	HT									1
*Modiola caroliniana**	0.3	25	EX								0.3	
*Nothoscordum gracile**	0.8	50	EX								0.8	
*Paspalum dilatatum**	0.8	5	HT									0.8
*Rosa spp.**	1	5	SG			1						
*Rubus fruticosus agg.**	8	60	HT									8
Senecio madagascarensis	0.5	10	HT									0.5
*Sida rhombifolia**	0.1	5	EX								0.1	
*Solanum sisymbriifolium**	0.1	1	EX								0.1	
*Verbena rigida**	1	10	EX								1	

Easting	292750
Northing	6264308
Orientation	120
Plot size	20 x 20
Attributes 20x50m plot	
Stem classes	
80+	2
50-79	1
30-49	No
20-29	Yes
10-19	Yes
5-9	Yes
<5	Yes
Hollows	0
Length logs (m)	2
Attributes 1x1 plot (%)	
Litter (%)	56

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Date: 17/9/18			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat
Q6: PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (Moderate Condition)			# spp	Count	Count	Count	Count	Count	Count	Count	Count	Count
Sheet version: 20170224.1531			33	17	3	3	3	5	0	3	16	5
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum
			122.2	39.3	21	9.6	4.8	2.5	0	1.4	82.9	71
Acacia falcata	6	40	SG			6						
Acacia parramattensis	4	10	TG		4							
*Anagallis arvensis**	0.2	10	EX								0.2	
Angophora floribunda	16	50	TG		16							
Aristida ramosa	0.4	10	GG				0.4					
*Briza subaristata**	3	80	EX								3	
Bursaria spinosa subsp. spinosa	3	15	SG			3						
Centella asiatica	0.8	30	FG					0.8				
Clematis glycinoides var. glycinoides	0.3	3	OG							0.3		
*Conyza bonariensis**	0.7	30	EX								0.7	
*Cotoneaster spp.**	1	3	HT									1
Cymbopogon refractus	0.4	10	GG				0.4					
Cynodon dactylon	4	100	GG				4					
Dianella longifolia var. longifolia	0.4	10	FG					0.4				
Dichondra repens	1	80	FG					1				
*Eragrostis curvula**	65	500	HT									65
Eucalyptus tereticornis	1	2	TG		1							
Glycine microphylla	0.1	2	OG							0.1		
Grevillea juniperina subsp. juniperina	0.6	10	SG			0.6						
Haloragis heterophylla	0.2	10	FG					0.2				
Hardenbergia violacea	1	10	OG							1		
*Ligustrum sinense**	1	5	HT									1
*Modiola caroliniana**	0.2	10	EX								0.2	
*Olea europaea**	3	2	HT									3
Oxalis perennans	0.1	5	FG					0.1				
*Paspalum dilatatum**	1	30	HT									1
*Pavonia hastata**	4	50	EX								4	
*Plantago lanceolata**	0.8	30	EX								0.8	
*Solanum sisymbriifolium**	0.2	5	EX								0.2	
*Taraxacum officinale**	0.2	10	EX								0.2	
*Verbascum sp.**	0.1	1	EX								0.1	
*Verbena officinalis**	0.5	10	EX								0.5	
*Verbena rigida**	2	50	EX								2	

Easting	293129
Northing	6263695
Orientation	250
Plot size	20 x 20
Attributes 20x50m plot	
Stem classes	
80+	0
50-79	0
30-49	Yes
20-29	Yes
10-19	Yes
5-9	Yes
<5	Yes
Hollows	1
Length logs (m)	0
Attributes 1x1 plot (%)	
Litter (%)	50

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Date: 17/9/18			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat
Q9: Miscellaneous Ecosystem (Highly disturbed areas with no or limited native vegetation)			# spp	Count	Count	Count	Count	Count	Count	Count	Count	Count
Sheet version: 20170224.1531			34	9	1	2	2	3	0	1	25	8
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum
			130.9	8.7	0.1	4	3.6	0.9	0	0.1	122.2	67.1
Angophora floribunda	0.1	1	TG		0.1							
*Araujia sericifera**	0.4	5	HT									0.4
*Briza subaristata**	4	100	EX								4	
Carex inversa	0.6	20	GG				0.6					
Centella asiatica	0.6	50	FG					0.6				
*Chloris gayana**	4	50	HT									4
*Conyza sumatrensis**	0.3	10	EX								0.3	
*Coreopsis lanceolata**	35	500	EX								35	
Cynodon dactylon	3	80	GG				3					
Dianella longifolia var. longifolia	0.2	10	FG					0.2				
*Eragrostis curvula**	20	200	HT									20
*Galium aparine**	0.1	10	EX								0.1	
Glycine tabacina	0.1	5	OG							0.1		
Grevillea juniperina subsp. juniperina	3	16	SG			3						
Hibbertia diffusa	1	20	SG			1						
*Hypochaeris radicata**	0.4	20	EX								0.4	
*Ligustrum sinense**	4	20	HT									4
*Nothoscordum gracile**	0.2	5	EX								0.2	
*Oxalis corniculata**	0.1	10	EX								0.1	
*Paspalum urvillei**	5	40	EX								5	
*Pavonia hastata**	2	30	EX								2	
Phyllanthus virgatus	0.1	5	FG					0.1				
*Plantago lanceolata**	3	100	EX								3	
*Romulea rosea var. australis**	0.3	20	EX								0.3	
*Rubus fruticosus agg.**	30	200	HT									30
*Senecio madagascariensis**	0.3	5	HT									0.3
*Sonchus asper**	0.4	20	EX								0.4	
*Sonchus oleraceus**	0.3	5	EX								0.3	
*Stellaria media**	0.2	5	EX								0.2	
*Stenotaphrum secundatum**	8	100	HT									8
*Tradescantia fluminensis**	0.4	3	HT									0.4
*Verbascum sp.**	0.2	5	EX								0.2	
*Verbena bonariensis**	3	50	EX								3	
*Vicia sativa subsp. sativa**	0.6	10	EX								0.6	

Easting	292852
Northing	6263926
Orientation	130
Plot size	20 x 20
BAM Attributes 20x50m plot	
Stem classes	
80+	0
50-79	0
30-49	No
20-29	No
10-19	No
5-9	No
<5	Yes
Hollows	0
Length logs (m)	0
BAM Attributes 1x1 plot (%)	
Litter (%)	2

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Date: 10/10/18			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat
Q10: PCT 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (Moderate Condition)			# spp	Count	Count	Count	Count	Count	Count	Count	Count	Count
Sheet version: 20170224.1531			18	11	2	1	4	2	1	1	7	3
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum
			72	31	25	0.1	5.4	0.2	0.2	0.1	41	40.3
*Anagallis arvensis**	0.1	4	EX								0.1	
Aristida ramosa	0.1	2	GG				0.1					
Cheilanthes sieberi subsp. sieberi	0.2	8	EG						0.2			
Commelina cyanea	0.1	2	FG					0.1				
Cynodon dactylon	5	50	GG				5					
*Eragrostis curvula**	40	100	HT									40
Eucalyptus moluccana	10	2	TG		10							
Eucalyptus tereticornis	15	30	TG		15							
Glycine tabacina	0.1	1	OG							0.1		
Melaleuca decora	0.1	1	SG			0.1						
Microlaena stipoides var. stipoides	0.1	4	GG				0.1					
*Opuntia spp.**	0.2	2	HT									0.2
*Oxalis corniculata**	0.1	4	EX								0.1	
Paspalidium distans	0.2	3	GG				0.2					
*Senecio madagascarensis**	0.1	2	HT									0.1
*Sida rhombifolia**	0.2	20	EX								0.2	
*Solanum sisymbriifolium**	0.3	3	EX								0.3	
Wahlenbergia communis	0.1	2	FG					0.1				

Easting	292930
Northing	6264740
Orientation	125
Plot size	20 x 20
BAM Attributes 20x50m plot	
Stem classes	
80+	1
50-79	2
30-49	Yes
20-29	Yes
10-19	Yes
5-9	No
<5	Yes
Hollows	0
Length logs (m)	4
BAM Attributes 1x1 plot (%)	
Litter (%)	25

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Date: 10/10/18			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat
Q11: PCT 724 Broad-leaved Ironbark - Grey Box-Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion (Low Condition)			#spp	Count	Count	Count	Count	Count	Count	Count	Count	Count
Sheet version: 20170224.1531			29	14	4	4	4	1	1	0	15	4
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum
			46.2	11.4	5.1	2.6	3.5	0.1	0.1	0	34.8	30.3
Acacia binervia	2	4	TG		2							
Acacia parramattensis	0.1	3	TG		0.1							
*Anagallis arvensis**	0.2	10	EX								0.2	
Angophora floribunda	1	6	TG		1							
Aristida ramosa	1	30	GG				1					
Cheilanthes sieberi subsp. sieberi	0.1	6	EG						0.1			
Cynodon dactylon	2	50	GG				2					
Dillwynia sieberi	1	8	SG			1						
Entolasia stricta	0.2	1	GG				0.2					
*Eragrostis curvula**	25	150	HT									25
Eucalyptus spp.	2	4	TG		2							
*Foeniculum vulgare**	0.2	3	EX								0.2	
*Gomphocarpus fruticosus**	0.1	2	EX								0.1	
Goodenia hederacea subsp. hederacea	0.1	8	FG					0.1				
Grevillea juniperina subsp. juniperina	1	8	SG			1						
*Hypochaeris radicata**	0.1	5	EX								0.1	
Jacksonia scoparia	0.3	2	SG			0.3						
*Ligustrum sinense**	0.2	1	HT									0.2
Lomandra filiformis subsp. coriacea	0.3	15	GG				0.3					
*Modiola caroliniana**	0.2	1	EX								0.2	
*Oxalis corniculata**	0.1	1	EX								0.1	
Ozothamnus diosmifolius	0.3	6	SG			0.3						
*Plantago lanceolata**	3	50	EX								3	
*Romulea rosea var. australis**	0.1	5	EX								0.1	
*Senecio madagascarensis**	0.1	3	HT									0.1
*Solanum sisymbriifolium**	0.2	8	EX								0.2	
*Stenotaphrum secundatum**	5	100	HT									5
*Verbena bonariensis**	0.2	4	EX								0.2	
*Vicia sativa subsp. sativa**	0.1	3	EX								0.1	

Easting	293086
Northing	6263801
Orientation	270
Plot size	20 x 20
BAM Attributes 20x50m plot	
Stem classes	
80+	0
50-79	0
30-49	No
20-29	No
10-19	No
5-9	No
<5	Yes
Hollows	0
Length logs (m)	0
BAM Attributes 1x1 plot (%)	
Litter (%)	3

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APPENDIX D

RECORDED FAUNA

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SCIENTIFIC NAME	COMMON NAME	EXOTIC / NATIVE	BC ACT[1]	EPBC ACT[2]
Amphibian (1)				
Crinia signifera	Common Eastern Froglet	Native		
Bird (30)				
Gymnorhina tibicen	Australian Magpie	Native		
Corvus coronoides	Australian Raven	Native		
Chenonetta jubata	Australian Wood Duck	Native		
Manorina melanophrys	Bell Miner	Native		
Coracina novaehollandiae	Black-faced Cuckoo-shrike	Native		
Acridotheres tristis	Common Myna	Exotic		
Ocyphaps lophotes	Crested Pigeon	Native		
Platycercus eximius	Eastern Rosella	Native		
Dromaius novaehollandiae	Emu	Native		
Eolophus roseicapilla	Galah	Native		
Cracticus torquatus	Grey Butcherbird	Native		
Dacelo novaeguineae	Laughing Kookaburra	Native		
Cacatua tenuirostris	Long-billed Corella	Native		
Grallina cyanoleuca	Magpie-lark	Native		
Vanellus miles	Masked Lapwing	Native		
Glossopsitta concinna	Musk Lorikeet	Native		
Philemon corniculatus	Noisy Friarbird	Native		
Manorina melanocephala	Noisy Miner	Native		
Anas superciliosa	Pacific Black Duck	Native		
Trichoglossus haematodus	Rainbow Lorikeet	Native		
Psephotus haematonotus	Red-rumped Parrot	Native		
Pycnonotus jocosus	Red-whiskered Bulbul	Exotic		
Zosterops lateralis	Silvereye	Native		

Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001

Tel: +61 2 9272 5100
Fax: +61 2 9272 5101
www.wsp.com

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Version: 1, Version Date: 26/11/2018

SCIENTIFIC NAME	COMMON NAME	EXOTIC / NATIVE	BC ACT[1]	EPBC ACT[2]
Streptopelia chinensis	Spotted Dove	Exotic		
Cacatua galerita	Sulphur-crested Cockatoo	Native		
Malurus cyaneus	Superb Fairy-wren	Native		
Petrochelidon nigricans	Tree Martin	Native		
Malurus lamberti	Variegated Fairy-wren	Native		
Hirundo neoxena	Welcome Swallow	Native		
Rhipidura leucophrys	Willie Wagtail	Native		
Invertebrate (1)				
Meridolum corneovirens	Cumberland Plain Snail	Native	E1	
Mammal (3)				
Macropus giganteus	Eastern Grey Kangaroo	Native		
Lepus europeaus	Hare	Exotic		
Wallabia bicolor	Swamp Wallaby	Native		
Reptile (1)				
Pseudonaja textilis	Eastern Brown Snake	Native		

(1) V = Vulnerable, E1 = Endangered species listed under the BC Act

(2) V = Vulnerable, E = Endangered, M = Migratory listed under the EPBC Act

APPENDIX E

SIGNIFICANCE ASSESSMENTS

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APPENDIX E SIGNIFICANT ASSESSMENTS

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1 VEGETATION COMMUNITIES

Within the Proposal footprint, three Plant Community Types which correspond to threatened ecological communities were recorded.

Table 1.1 Plant community types which correspond to threatened ecological communities

PLANT COMMUNITY TYPES	CONDITION CLASS	THREATENED ECOLOGICAL COMMUNITY	BC ACT STATUS	EPBC ACT STATUS	PROPOSAL FOOTPRINT (HA)	VEGETATION EXCLUSION ZONES (HA)	PROPOSAL FOOTPRINT IMPACT (HA
PCT 724 Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Shale Gravel Transition Forest in the Sydney Basin Bioregion	Endangered	Critically Endangered	0.90	0.57	0.33
	Poor		Endangered	Not listed	0.49	0.00	0.49
PCT 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Endangered	Not listed	1.91	0.00	1.91
PCT 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered	Not listed	0.55	0.55	0.00

1.1 SHALE-GRAVEL TRANSITION FOREST

1.1.1 STATUS

Shale Gravel Transition Forest is listed as Endangered under the BC Act and Critically Endangered under the EPBC Act. Within the Proposal footprint two condition forms were recorded; Moderate and Poor. Under the EPBC Act, Poor condition form of this community is not recognised due to the lack of over storey.

1.1.2 DESCRIPTION

Shale Gravel Transition Forest has an open forest structure with a canopy dominated by *Eucalyptus fibrosa* (Broad-leaved Ironbark), with *Eucalyptus moluccana* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum) occurring less frequently. *Melaleuca decora* is common in the small tree layer. A sparse shrub layer is usually present which includes *Bursaria spinosa* (Blackthorn), *Daviesia ulicifolia* and *Lissanthe strigosa*.

This community is known to occur primarily where shallow deposits from ancient river systems overlay shale soils, but also associated with localised concentrations of iron-hardened gravel. The shrub understorey includes a number of listed threatened species in the Fabaceae family due to their nitrogen fixing root nodules to extract nutrients form the poor soils (NSW Scientific Committee 2011)

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1.1.3 DISTRIBUTION

Mainly found in the northern section of the Cumberland Plain, western Sydney, in the Richmond, Marsden Park and Windsor districts. Also appears in the Liverpool/ Holsworthy area, and there are small occurrences at Bankstown, Yennora and Villawood and the Kemps Creek area. There are 1,700 ha remaining intact. Good examples can be seen at Windsor Downs Nature Reserve and Kemps Creek Nature Reserve (NSW Scientific Committee 2011).

1.1.4 SPECIFIC IMPACTS

Within the Proposal Footprint, Shale Gravel Transition Forest occupied 1.39 ha across two condition forms; Moderate condition and Poor condition. This includes 0.90 ha of Moderate condition vegetation where >50% of ground strata vegetation was comprised of exotic perennial grasses (particularly *Eragrostis curvula** (African Love Grass)). The remaining 0.49 ha was recorded Poor condition vegetation and occurred as regrowth due to historical land clearing.

Within the Proposal Footprint, impact to Shale Gravel Transition Forest in Moderate condition would be minimal as linear patches of this community which occur to the North and South of the decommissioned Ropes Creek Railway Line would not be cleared and have been mapped as Vegetation Exclusion Zones. Vegetation Exclusions Zones encompass 0.57 ha of moderate condition of Shale Gravel Transition Forest, as such the Proposal will impact 0.33 ha.

Poor condition form to the South of Dunheved Circuit and Moderate condition form of Shale Gravel Transition Forest outside of the Vegetation Exclusion Zones to the North of Lee Holm Road and Christie Street are likely to be impacted.

1.1.5 BC ACT ASSESSMENT

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**

The proposal would involve the clearing of 0.82 ha of Shale Gravel Transition Forest in the Sydney Basin Bioregion, this represents <1 % of the current extent of 1700 ha estimated to occur within the Sydney Basin (Tozer, Turner et al. 2010, Office of Environment & Heritage 2018). As the proportion of Shale Gravel Transition to be impacted is small, it is considered unlikely to have an adverse effect on the extent of the community such that its local occurrence is likely to be placed at risk of extinction

- **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

The proposal would involve the clearing 0.82 ha of Shale Gravel Transition Forest in the Sydney Basin Bioregion, this represents <1 % of the current extent (1700 ha) estimated to occur within the Sydney Basin (Tozer, Turner et al. 2010, Office of Environment & Heritage 2018). As the proportion of Shale Gravel Transition to be impacted is small, it is considered unlikely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

In relation to the habitat of a threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed**

A total of 0. 82 ha of Shale Gravel Transition Forest would be impacted by the proposal. This includes 0.33 ha of Moderate condition vegetation with >50% of ground strata vegetation is comprised of exotic perennial grasses and 0.49 ha encompasses Poor condition vegetation which occurred as regrowth.

— **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action**

The proposal would remove small sections of the Shale Gravel Transition Forest recorded. Within locality of the Proposal Footprint, connectivity between vegetation is limited and confined to linear strips of vegetation which run parallel with Christie Street and Forrester Road. These linear patches to the North and South of the decommissioned Ropes Creek Railway line, which connect to Shale Gravel Transition Forest have been mostly excluded from direct impact and have been shown as Vegetation Exclusion Zones in Figure 3.2 in the main report.

As such, the Shale Gravel Transition Forest likely to be impacted by the proposal include a linear strip of Poor condition vegetation South of Dunheved Circuit and two small areas of Moderate condition Shale Gravel Transition Forest which were recorded adjacent to either Christie Street or vegetation in Poor condition. It is unlikely that habitat for this community would become significantly fragmented or isolated from other areas of habitat.

— **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

A total of 0.82 ha of Shale Gravel Transition Forest would be impacted by the proposal. This includes 0.33 ha of Moderate condition vegetation with >50% of ground strata vegetation comprised of exotic perennial grasses and 0.49 ha of Poor condition vegetation which occurred as regrowth. Overall, this represented <1% of the current extent (1700 ha) estimated to occur within the Sydney Basin (Tozer, Turner et al. 2010, Office of Environment & Heritage 2018).

As the Shale Gravel Transition Forest to be impacted by the proposal is small in extent and proportion, and was recorded in degraded condition, it is considered unlikely that the habitat to be removed, modified, fragmented or isolated is important to the long-term survival of the Shale Gravel Transition Forest in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat has been identified for Cumberland Plain Woodland under the BC Act (NSW Scientific Committee 2011).

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Cumberland Plain Recovery Plan (Office of Environment Heritage and Water 2011) addressed Shale Gravel Transition Forest (SGTF) and activities to assist SGTF outlined by Office of Environment and Heritage (Office of Environment and Heritage 2017) are addressed Table 1.4 below. The Proposal is not consistent with one activity identified to assist SGTF.

Table 1.2 Cumberland Plain recovery plan objectives

CUMBERLAND PLAIN RECOVERY PLAN OBJECTIVES	LIKELY TO BE AFFECTED BY PROPOSAL?
Cumberland plain recovery plan (Office of Environment Heritage and Water 2011)	
To build a protected area networks, comprising public and private lands, focused on the priority conservation lands	No.
To deliver best practise management for threatened biodiversity across the Cumberland Plain, with a specific focus on the priority conservation lands and public lands where the primary management objectives are compatibles with biodiversity conservation	No.
To develop an understanding and enhance awareness in the community of the Cumberland Plain's threatened biodiversity, the best practise standards for tis management and recovery program	No.
To increase knowledge of the threats to the survival of the Cumberland Plain's threatened biodiversity, and thereby improve capacity to manage these in a strategic and effective manner	No.
Activities to Assist SGTF (Office of Environment and Heritage 2017)	
Promote public involvement in restoration activities.	No.
Apply necessary fire regimes to maintain appropriate floristic and structural diversity.	No.

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CUMBERLAND PLAIN RECOVERY PLAN OBJECTIVES	LIKELY TO BE AFFECTED BY PROPOSAL?
Protect habitat by minimising further clearing. This requires recognition of the values of all remnants.	Yes – 0.82 ha of SGTF was recorded
Promote regeneration by avoiding prolonged or heavy grazing.	No.
Weed control.	No.
Undertake restoration including bush regeneration and revegetation.	No.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Proposal directly contributes to the following Key Threatened Processes listed under the BC Act:

- clearing of Native Vegetation
- loss of hollow-bearing trees
- bushrock removal
- removal of dead wood and dead trees.

The Proposal may indirectly contribute to the following additional Key Threatening Processes:

- infection of native plants by *Phytophthora cinnamomi*
- introduction and establishment of exotic rust fungi of the order pucciniales pathogenic on plants of the family myrtaceae
- invasion and establishment of exotic vines and scramblers
- invasion of native plant communities by African olive O*lea europaea* subsp. c*uspidata*
- invasion of native plant communities by exotic perennial grasses

Mitigation measures outlined in section 5 of the main report have been recommended to decrease the impact of the key threatening process the proposal may indirectly contribute to.

Conclusion

The proposal is likely to impact on 0.82 ha of Shale Gravel Transition Forest, this vegetation represents <1% of this community previously recorded within locality (Tozer, Turner et al. 2010, Office of Environment & Heritage 2018).

Of the Shale Gravel Transition Forest recorded, 0.33 ha occurred as Moderate condition vegetation where >50% of ground strata vegetation was comprised of exotic perennial grasses (particularly *Eragrostis curvula** (African Love Gras)). The remaining 0.49 ha was recorded Poor condition vegetation and occurred as regrowth due to historical land clearing.

As such, the proposal is unlikely to have a significant impact on Shale Gravel Transition Forest or its habitat.

1.1.1 EPBC ACT SIGNIFICANCE ASSESSMENT

Medium condition Shale Gravel Transition Forest is protected under the EPBC Act (refer to section 4 of the main report). The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (NSW Scientific Committee 2009).

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

- **Reduce the extent of an ecological community.**

The Proposal would impact on 0.33 ha of Shale Gravel Transition Forest protected under the EPBC Act. Medium condition vegetation recorded within the Proposal Footprint displayed weed invasion with >50% of the understorey being comprised of exotic perennial grasses. Vegetation occurred at or near the edges of disturbances such as Christie Street and the decommissioned Ropes Creek Railway Line and is subject to edge effects such as weed invasion and a higher abundance of exotic pest animals and aggressive generalist native bird species.

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

The proposal would impact on <1% of Shale Gravel Transition Forest has been previously recorded (Tozer, Turner et al. 2010, Office of Environment & Heritage 2018) within the Sydney Basin Bioregion.

Within the Proposal Footprint Shale Gravel Transition Forest was recorded on either side of a decommissioned Ropes Creek Railway Line which runs parallel to Christie Street. These linear patches to the North and South of the decommissioned Ropes Creek Railway Line have been mostly excluded from direct impact and have been shown as Vegetation Exclusion Zones in Figure 3.2 in the main report. Direct impact is limited to the edges of these limited strips and hence is unlikely to fragment or further increase fragmentation of Shale Gravel Transition Forest.

— **Adversely affect habitat critical to the survival of an ecological community**

There is no critical habitat listed under the EPBC Act for Shale Gravel Transition Forest. Within the Cumberland Plain Recovery Plan (Section 12), Priority Conservation Lands are considered to contain habitat critical to the survival of threatened entities, including SGTF (Office of Environment Heritage and Water 2011). No part of the Proposal Footprint has been identified as Priority Conservation Land.

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

Though the proposal would modify the soil profile in the areas that require clearing of vegetation, this impact is unlikely to significantly modify abiotic factors such as the soil profile, groundwater levels of surface water drainage patterns necessary to the survival of remaining Shale Gravel Transition Forest surrounding the Proposal Footprint.

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

Shale Gravel Transition Forest to be impacted is currently fragmented by the Ropes Creek decommissioned Railway Line and experiences associated edge effects. Whilst the proposal may introduce edge effects to the remaining Shale Gravel Transition Forest immediately adjacent to the proposal it is unlikely these impacts would be significant.

The proposal does not involve actions that would significantly change the existing disturbance regime such as the intensity or frequency of fires, the intensity or frequency floods.

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

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

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

All Shale Gravel Transition Forest within the Proposal Footprint occurred in linear patches parallel to the Ropes Creek decommissioned Railway Line, as a result the majority of this community was affected by weed invasion. As such the proposal has potential to result in minor increases in the establishment, density or diversity of weed species to the remaining Shale Gravel Transition Forest immediately adjacent to the proposal.

As Shale Gravel Transition Forest within the Proposal Footprint already contains invasive species, the proposal is unlikely to exacerbate invasive species such that it would substantially reduce the quality or integrity of the community's occurrence within proximity to the proposal. The proposal does not involve other processes that are likely to reduce the quality or integrity of Shale Gravel Transition Forests other than those described above.

Interfere with the recovery of an ecological community

Though a recovery plan has not been prepared for Shale Gravel Transition Forest in accordance with the requirements of the EPBC Act, a recovery plan has been prepared for vegetation communities on the Cumberland Plain under the BC Act and the EPBC Act (Office of Environment Heritage and Water 2011) which includes references to Shale Gravel Transition Forest. The proposal would interfere with one objective detailed in the Cumberland Plain Recovery Plan (Table 1.2), being to 'protect habitat by minimising further clearing. This requires recognition of the values of all remnants.'. As the Proposal will involve the clearing of 0.33 ha of Shale Gravel Transition Forest, it is not consistent with the Cumberland Plain Recovery Plan. However, due to the

small extent and proportion of the vegetation to be cleared, and degraded condition it was recorded in, this impact is considered unlikely to significantly interfere with the recovery of Shale Gravel Transition Forest.

Conclusion

Medium condition patches of Shale Gravel Transition Forest are consistent with the Critically Endangered listing under the EPBC Act and form 0.33 ha within the Proposal Footprint (excluding Vegetation Exclusion Zones). It is considered unlikely to be significantly impacted by the Proposal, as such a referral of this proposal is not required.

1.2 RIVER-FLAT EUCALYPT FOREST

1.2.1 STATUS

River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions is listed as Endangered under the BC Act.

1.2.2 DESCRIPTION

River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions is found on the river flats of the coastal floodplains. It has a tall open tree layer of eucalypts, which may exceed 40 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus amplifolia* (Cabbage Gum), *Angophora floribunda* (Rough-Barked Apple) and *Angophora subvelutina* (Broad-Leaved Apple).

A layer of small trees may be present, including *Melaleuca decora, Melaleuca styphelioides* (Prickly-Leaved Teatree), *Backhousia myrtifolia* (Grey Myrtle), *Melia azaderach* (White Cedar), *Casuarina cunninghamiana* (River Oak) and *Casuarina glauca* (Swamp Oak).

Scattered shrubs include *Bursaria spinosa, Solanum prinophyllum, Rubus parvifolius, Breynia oblongifolia, Ozothamnus diosmifolius, Hymenanthera dentata, Acacia floribunda* and *Phyllanthus gunnii.* The groundcover is composed of abundant forbs, scramblers and grasses including *Microlaena stipoides, Dichondra repens, Glycine clandestina, Oplismenus aemulus, Desmodium gunnii, Pratia purpurascens, Entolasia marginata, Oxalis perennans* and *Veronica plebeia.*

1.2.3 DISTRIBUTION

Known from parts of the Local Government Areas of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Palerang, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions.

1.2.4 SPECIFIC IMPACTS

Within the Proposal Footprint, River-Flat Eucalypt Forest occupied 1.91 ha which was recorded in Moderate condition where where >50% of ground strata vegetation was comprised of exotic perennial grasses (particularly *Eragrostis curvula** (African Love Grass) and exotic scramblers (particularly *Rubus fruticosus** (Blackberry)).

1.2.5 BC ACT ASSESSMENT

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

The proposal would involve the clearing of 1.91 ha of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions, this represents < 1 % of the current extent of the 4729 ha estimated to occur within the Sydney Basin (Office of Environment & Heritage 2018). As the proportion of River-Flat Eucalypt Forest to be impacted is small, it is considered unlikely to have an adverse effect on the extent or to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

In relation to the habitat of a threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed**

Within the Proposal Footprint, River-Flat Eucalypt Forest occupied 1.91 ha which was recorded in Moderate condition where >50% of ground strata vegetation was comprised of exotic perennial grasses (particularly *Eragrostis curvula** (African Love Grass) and exotic scramblers (particularly *Rubus fruticosus** (Blackberry).

- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action**

The proposal would remove sections of the River-Flat Eucalypt Forest recorded. Within locality of the Proposal Footprint, connectivity between vegetation is limited and confined to riparian vegetation along tributaries of South Creek. As such, it is unlikely that habitat for this community would become significantly fragmented or isolated from other areas of habitat

- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

A total of 1.91 ha of River-Flat Eucalypt would be impacted by the proposal. All vegetation recorded occurred in Moderate condition vegetation with >50% of ground strata vegetation comprised of exotic perennial grasses (particularly *Eragrostis curvula** (African Love Grass) and exotic scramblers (particularly *Rubus fruticosus** (Blackberry). Overall, this represented <1% of the current extent (4729 ha) estimated to occur within the Sydney Basin (Office of Environment & Heritage 2018).

As the River-Flat Eucalypt to be impacted by the proposal is small in extent and proportion and was recorded in degraded condition it is considered unlikely the habitat to be removed, modified, fragmented or isolated is important to the long-term survival of the River-Flat Eucalypt in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat has been identified for River-Flat Eucalypt Forest under the BC Act (NSW Scientific Committee 2011).

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Cumberland Plain Recovery Plan (Office of Environment Heritage and Water 2011) addressed River-Flat Eucalypt Forest (RFEF) and activities to assist RFEF outlined by Office of Environment and Heritage (Office of Environment and Heritage 2017) are addressed Table 1.4 below. The Proposal is not consistent with one activity identified.

Table 1.3 Cumberland Plain recovery plan objectives

CUMBERLAND PLAIN RECOVERY PLAN OBJECTIVES	LIKELY TO BE AFFECTED BY PROPOSAL?
Cumberland Plain recovery plan (Office of Environment Heritage and Water 2011)	
To build a protected area networks, comprising public and private lands, focused on the priority conservation lands	No.

CUMBERLAND PLAIN RECOVERY PLAN OBJECTIVES	LIKELY TO BE AFFECTED BY PROPOSAL?
To deliver best practise management for threatened biodiversity across the Cumberland Plain, with a specific focus on the priority conservation lands and public lands where the primary management objectives are compatibles with biodiversity conservation	No.
To develop an understanding and enhance awareness in the community of the Cumberland Plain's threatened biodiversity, the best practise standards for tis management and recovery program	No.
To increase knowledge of the threats to the survival of the Cumberland Plain's threatened biodiversity, and thereby improve capacity to manage these in a strategic and effective manner	No.
Activities to Assist RFEF (Office of Environment and Heritage 2017)	
Instigate feral animal control programs.	No.
Ensure that the fire sensitivity of the community is considered when planning hazard reduction and asset management burning.	No.
Protect habitat by minimising further clearing of the community. This requires recognition of the values of all remnants in the land use planning process.	Yes – 1.91 ha of RFEF was recorded
Promote regeneration by avoiding prolonged or heavy grazing.	No.
Undertake restoration including bush regeneration, revegetation and weed control, and promote public involvement in this restoration.	No.
nstigate feral animal control programs.	No.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Proposal directly contributes to the following Key Threatened Processes listed under the BC Act:

- clearing of Native Vegetation
- loss of hollow-bearing trees
- bushrock removal
- removal of dead wood and dead trees.

The Proposal may indirectly contribute to the following additional Key Threatening Processes:

- infection of native plants by *Phytophthora cinnamomi*
- introduction and establishment of exotic rust fungi of the order pucciniales pathogenic on plants of the family myrtaceae
- invasion and establishment of exotic vines and scramblers
- invasion of native plant communities by African olive O*lea europaea* subsp. c*uspidata*
- invasion of native plant communities by exotic perennial grasses

Mitigation measures outlined in section 5 of the main report have been recommended to decrease the impact of the key threatening process the proposal may indirectly contribute to.

Conclusion

The proposal would involve the clearing of 1.91 ha of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions, this represents < 1 % of the current extent of the 4729 ha estimated to occur within the Sydney Basin (Office of Environment and Heritage, 2018a). Within the Proposal Footprint, River-Flat Eucalypt Forest occupied was recorded in Moderate condition where >50% of ground strata vegetation was comprised of exotic perennial grasses (particularly *Eragrostis curvula** (African Love Grass) and/or exotic scramblers (particularly *Rubus fruticosus** (Blackberry).

As the River-Flat Eucalypt Forest to be impacted is small in extent and proportion and occurs as moderate condition vegetation, it is considered unlikely the proposal would have a significant impact on River-Flat Eucalypt Forest or its habitat.

1.3 CUMBERLAND PLAIN WOODLAND

1.3.1 STATUS

Cumberland Plain Woodland is listed as a Critically Endangered Ecological Community under the both BC Act and EPBC Act. Vegetation recorded within the Proposal Footprint does not commensurate with EPBC listing.

1.3.2 DESCRIPTION

Cumberland Plain Woodland ecological community occur on soils derived from wianamatta shale. The community has a characteristically woodland structure, but may include both more open and dense areas of vegetation and derived grasslands (NSW Scientific Committee 1997, Department of Environment and Water Resources 2007). *Eucalyptus moluccana* and *Eucalyptus tereticornis* are the dominant canopy trees, with *Eucalyptus crebra* and *Eucalyptus eugenioides* occurring less frequently. The shrub layer is dominated by *Bursaria spinosa*. Diversity is highest in the ground stratum with a high diversity of grasses and other small shrubs and herbaceous species occurring. The species composition is a good indicator of condition, with native groundcover species, including less common and slower-growing native grasses and herbs, being good indicators of regeneration potential (resilience, Department of Environment and Conservation 2005).

1.3.3 DISTRIBUTION

The original extent of this ecological community is highly reduced with estimates ranging from 6% to 9% remaining (NSW Scientific Committee 2008).

Within the Proposal Footprint, Cumberland Plain Woodland was recorded in the northern section of the Proposal Footprint as a discrete patch in Moderate condition. Native canopy was recorded however the understorey was dominated by exotic perennial grasses, particularly *Eragrosits curvula** (African Love Grass).

1.3.4 SPECIFIC IMPACTS

A total of 0.55 ha of Cumberland Plain Woodland was recorded within the Proposal Footprint. All vegetation was located within Vegetation Exclusion Zones and will not be subject to clearing.

1.3.5 BC ACT ASSESSMENT

In the case of a Threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Within the Proposal Footprint 0.55 ha of Cumberland Plain Woodland (CPW) was recorded. This vegetation occurs within a Vegetation Exclusion Zone for the proposal and would not be subject to clearing.

In relation to the habitat of a Threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**

— **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**

The proposal would impact on 0.00 ha of Cumberland Plain Woodland as the vegetation recorded has been identified by the proposal as a Vegetation Exclusion Zone and would not be subject to clearing. As such, the proposal would not fragment areas of habitat.

— **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

Cumberland Plain Woodland recorded within the Proposal Footprint represents <1% of CPW previously recorded within locality (Tozer et al., 2010). Of the CPW recorded, all occurred in Moderate condition with a native canopy however the understorey was dominated by exotic perennial grasses, particularly *Eragrosits curvula** (African Love Grass).

As such, it is unlikely the proposal would impact on habitat important to the long-term survival of Cumberland Plain Woodland in the locality

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat has been identified for Cumberland Plain Woodland under the BC Act (NSW Scientific Committee 2011).

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Cumberland Plain Recovery Plan (Office of Environment Heritage and Water 2011) and activities to assist Cumberland Plain Woodland outlined by Office of Environment and Heritage (Office of Environment and Heritage 2017) are addressed Table 1.4 below.

Table 1.4 Cumberland Plain recovery plan objectives

CUMBERLAND PLAIN RECOVERY PLAN OBJECTIVES	LIKELY TO BE AFFECTED BY PROPOSAL?
Cumberland plain recovery plan (Office of Environment Heritage and Water 2011)	
To build a protected area networks, comprising public and private lands, focused on the priority conservation lands	No.
To deliver best practise management for threatened biodiversity across the Cumberland Plain, with a specific focus on the priority conservation lands and public lands where the primary management objectives are compatibles with biodiversity conservation	No.
To develop an understanding and enhance awareness in the community of the Cumberland Plain's threatened biodiversity, the best practise standards for tis management and recovery program	No.
To increase knowledge of the threats to the survival of the Cumberland Plain's threatened biodiversity, and thereby improve capacity to manage these in a strategic and effective manner	No.
Activities to Assist CPW (Office of Environment and Heritage 2017)	
Promote public involvement in restoration activities.	No.
Sites should be burned in a mosaic pattern, with no more than 40% of the community present in the management area burnt within any 10 year period. No more than 10% of the community within any management area should be burnt in one planned event. Any area to be subject to a planned burn should be assessed by suitably qualified persons to ensure species present in the area will not be adversely affected by the planned burning event.	No.
Protect habitat by minimising further clearing of the community. This requires recognition of the values of all remnants.	No.
Promote regeneration by avoiding mowing or prolonged or heavy grazing.	No.
Protect habitat by controlling run-off entering the site if it would change water, nutrient or sediment levels or cause erosion.	No.

CUMBERLAND PLAIN RECOVERY PLAN OBJECTIVES	LIKELY TO BE AFFECTED BY PROPOSAL?
Weed control.	No.
Undertake restoration including bush regeneration and revegetation.	No.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Proposal would not directly contribute to any Key Threatened Processes as the clearing of Cumberland Plain Woodland would not occur. Several Key Threatening Processes listed under the BC Act which may be contributed to indirectly include:

- infection of native plants by *phytophthora cinnamomi*
- introduction and establishment of exotic rust fungi of the order pucciniales pathogenic on plants of the family myrtaceae
- invasion and establishment of exotic vines and scramblers
- invasion of native plant communities by African olive O*lea europaea* subsp. c*uspidata*
- invasion of native plant communities by exotic perennial grasses

Mitigation measures outlined in section 5 of the main report have been recommended to decrease the impact of the key threatening process the proposal may indirectly contribute to.

Conclusion

The proposal is likely to impact on 0.00 ha of Cumberland Plain Woodland. As such, the proposal is unlikely to lead to a significant impact on Cumberland Plain Woodland or its habitat.

2 FLORA

2.1 DILLWYNIA TENUIFOLIA

2.1.1 STATUS

Dillwynia tenuifolia is a threatened flora species listed as Vulnerable under the TSC Act.

2.1.2 DESCRIPTION

Dillwynia tenuifolia usually grows locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. At Yengo, is reported to occur in disturbed escarpment woodland on Narrabeen sandstone. The species flowers between August and March and has no known pollinators. The plants are estimated to have a life span of 20-30 years with a minimum of 3-4 years is required before seed is produced. The seeds are hard coated and are persistent in the soil seed bank. Dispersal is likely to be localised and ants are the probable vectors. The plants are skilled during fires and is re-established from a soil seedbank with known occurrences of prolific seed germination in response of fire (NSW Office of Environment and Heritage 2018).

2.1.3 SPECIFIC IMPACTS

During field surveys nine *Dillwynia tenuifolia* individuals were recorded within PCT 724 (Shale Gravel Transition Forest). The proposal would not involve the clearing of any *Dillwynia tenuifolia* individuals recorded during field surveys. A total of 0.82 ha of potential habitat for *Dillwynia tenuifolia* would be impacted by the proposal.

2.1.4 DISTRIBUTION

Dillwynia tenuifolia is a low spreading shrub to 1 m tall with a core distribution within the Cumberland Plain from Windsor and Penrith East to Dean Park near Colebee. Other populations in western Sydney are recorded from Voyager Point and Kemps Creek in the Liverpool LGA, Luddenham in the Penrith LGA and South Maroota in the Baulkham Hills Shire. Disjunct localities outside the Cumberland Plain include the Bulga Mountains at Yengo in the north, and Kurrajong Heights and Woodford in the Lower Blue Mountains (NSW Office of Environment and Heritage 2018).

2.1.5 SPECIFIC IMPACTS

During field surveys nine *Dillwynia tenuifolia* individuals were recorded within PCT 724 (Shale Gravel Transition Forest). The proposal would not involve the clearing of any *Dillwynia tenuifolia* individuals recorded during field surveys. A total of 0.82 ha of potential habitat for *Dillwynia tenuifolia* would be impacted by the proposal.

2.1.6 BC ACT ASSESSMENT

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The proposal would not involve the clearing of any *Dillwynia tenuifolia* individuals recorded during field surveys.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable

In relation to the habitat of a threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

A total of 0.82 ha of potential habitat for *Dillwynia tenuifolia* would be impacted by the proposal. The proposal has identified areas which are important for connectivity as Vegetation Exclusion Zones, these areas would not be subject to clearing. As such, the proposal is unlikely to fragment or isolate areas of habitat.

The potential habitat to be impacted includes 0.33 ha of Moderate condition vegetation with >50% of ground strata vegetation is comprised of exotic perennial grasses and 0.49 ha encompasses Poor condition vegetation which occurred as regrowth. The vegetation to be impacted represents <1% of similar habitat (CPT 724) within locality of the proposal (NSW Office of Environment and Heritage 2018)

As the habitat to be removed is considered moderate and low condition and represents a small portion of available habitat within locality, it is unlikely to be important for the long-term survival of the *Dillwynia tenuifolia*.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat has been identified for *Dillwynia tenuifolia* under the BC Act. Key management sites have been identified under the Saving Our Species program, none of which are located within the Proposal Footprint (NSW Office of Environment and Heritage 2018).

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Office of Environment and Heritage have identified activities to assist *Dillwynia tenuifolia* as listed in Table 2.1. The proposal would affect one management activity as 0.82 ha of potential habitat for the species would be impacted.

Table 2.1 Activities to assist *Dillwynia tenuifolia*

ACTIVITIES TO ASSIST *DILLWYNIA TENUIFOLIA*	**LIKELY TO BE AFFECTED BY PROPOSAL?**
Exclude fire from remnants where possible.	No.
Prevent further loss and fragmentation of habitat.	Yes – The proposal would impact on 0.82 ha of potential habitat
Fencing to limit access to sites is recommended, as is the potential to use camera surveillance and signage to reduce the incidence of dumping.	No.
Removal of dumped materials and restricting access may be valuable to reducing harm to populations.	No.
Weed control, using appropriate methods, will be required to manage fuel loads and reduce competition.	No.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Proposal directly contributes to the following Key Threatened Processes listed under the BC Act:

- clearing of Native Vegetation (which forms potential habitat for *Dillwynia tenuifolia)*

The Proposal may indirectly contribute to the following additional Key Threatening Processes which have potential to negetivley impact potential habitat for *Dillwynia tenuifolia*:

- infection of native plants by *Phytophthora cinnamomi*
- introduction and establishment of exotic rust fungi of the order pucciniales pathogenic on plants of the family myrtaceae
- invasion and establishment of exotic vines and scramblers
- invasion of native plant communities by O*lea europaea* subsp. *cuspidata** (African olive)
- invasion of native plant communities by exotic perennial grasses

Mitigation measures outlined in section 5 of the main report have been recommended to decrease the impact of the key threatening process the proposal may indirectly contribute to.

Conclusion

The proposal would not involve the clearing of any *Dillwynia tenuifolia* individuals recorded during field surveys. A total of 1.39 ha of potential habitat for *Dillwynia tenuifolia* was recorded within the Proposal Footprint. Of this, 0.57 ha, is confined to the peripheries of the habitat as areas which are important for connectivity, and have been mapped as Vegetation Exclusion Zones which will not be subject to clearing. As such, the proposal is unlikely to fragment or isolate areas of significantly habitat habitat.

The potential habitat to be impacted includes 0.82 ha, 0.33 ha formed Moderate condition vegetation with >50% of ground strata vegetation is comprised of exotic perennial grasses and 0.49 ha encompasses Poor condition vegetation which occurred as regrowth. The vegetation to be impacted represents <1% of similar habitat (PCT 724) within locality of the proposal (NSW Scientific Committee 2011, NSW Office of Environment and Heritage 2018).

As no individuals would be removed and the potential habitat to be impacted is considered moderate and low condition and represents a small portion of available habitat within locality, it is unlikely the proposal would have a significant impact on *Dillwynia tenuifolia.*

2.2 *GREVILLEA JUNIPERINA* SUBSP. *JUNIPERINA*

2.2.1 STATUS

Grevillea juniperina subsp. *juniperina* is a threatened flora species listed as Vulnerable under the BC Act.

2.2.2 DESCRIPTION

This threatened species is known to grow on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels with associated habitat including Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest.

Associated canopy species within Cumberland Plain Woodland and Shale/Gravel Transition Forest include *Eucalyptus tereticornis, Eucalyptus moluccana, Eucalyptus crebra, Eucalyptus fibrosa* and *Eucalyptus eugenioides*. Understorey species include *Bursaria spinosa, Dillwynia sieberi, Ozothamnus diosmifolius, Daviesia ulicifolia, Acacia falcata, Acacia parramattensis, Themeda triandra, Aristida ramosa, Cymbopogon refractus, Eragrostis brownii, Cheilanthes sieberi, Dianella revoluta* and *Goodenia hederacea* (NSW Office of Environment and Heritage 2018).

2.2.3 DISTRIBUTION

Restricted to the western Cumberland Plain, Marsden Park, Rooty Hill, Riverstone, Plumpton, Castlereagh NR, Blacktown, Penrith and north to Pitt Town, where it grows in open dry sclerophyll (eucalypt-dominated) forest or woodland in sandy to clay-loam soils and red pseudolateritic or sandy gravels (Fairley and Moore 2002, Royal Botanic Gardens 2018).

2.2.4 SPECIFIC IMPACTS

During field surveys, 1, 273 individuals of *Grevillea juniperina* subsp. *juniperina* were recorded. Of these, 793 falls within the Proposal Footprint and 141 falls within Vegetation Exclusions Zones. As such, the Proposal will impact on 652 individuals of *Grevillea juniperina* subsp. *juniperina* and 2.73 ha of potential habitat in the form of PCT 724 and PCT 835. *Grevillea juniperina* subsp. *juniperina* was recorded in PCT 849, this plant community type would not be impacted by the proposal.

2.2.5 BC ACT ASSESSMENT

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Proposal footprint would result in the loss of 652 individuals of *Grevillea juniperina* subsp. *juniperina* and approximately 2.73 ha of potential habitat in the form of PCT 724 and PCT 835.

The population within the Proposal footprint is considered to form part of a larger local population that includes the Shane's Park saving our species key management site that incorporates both public and private lands and covers about 2,897 hectares (refer to Figure 4.1 in the main report).

As the Proposal footprint will impact on <1% of habitat for the local population of *Grevillea juniperina* subsp. *juniperina*, it is considered unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable

In relation to the habitat of a threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The Proposal would impact 2.73 ha of potential habitat for *Grevillea juniperina* subsp. *juniperina* and 652 individuals.

Areas of habitat connectivity have been excluded from impact and retained as vegetation exclusion zones. These areas encompass 1.12 ha of known habitat and 141 *Grevillea juniperina* subsp. *juniperina* individuals. As such, the Proposal footprint is considered unlikely to lead to significant fragmentation of habitat.

Potential habitat to be impacted represents <1% of the 2,897 hectares within the Shane's Park saving our species key management site that incorporates both public and private lands. As the habitat to be impacted is small in extent and proportion, it is not considered important to the long-term survival of the species.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat has been identified for *Grevillea juniperina* subsp. *juniperina* under the BC Act. Key management sites have been identified under the Saving Our Species program which are located within close proximity to the Proposal Footprint. No key management sites intersect with the Proposal Footprint (Office of Environment & Heritage 2018).

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Office of Environment and Heritage have identified activities to assist *Grevillea juniperina* subsp. *juniperina* as listed in Table 2.2. The proposal would affect one management activity as 2.73 ha of potential habitat for the species would be impacted.

Table 2.2 Activities to assist *Grevillea juniperina* subsp. *juniperina*

ACTIVITIES TO ASSIST *GREVILLEA JUNIPERINA* SUBSP. *JUNIPERINA*	LIKELY TO BE AFFECTED BY PROPOSAL?
Fire intervals of 10-15 yrs (where there are no needs for asset protection zones).	No.
Protect known habitat areas from clearing and disturbance.	Yes – The proposal would impact on 2.73 ha of potential habitat
Control unauthorised access.	No.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Proposal directly contributes to the following Key Threatened Processes listed under the BC Act:

- clearing of Native Vegetation (which forms potential habitat for *Grevillea juniperina* subsp. *juniperina)*

The Proposal footprint may indirectly contribute to the following additional Key Threatening Processes which have potential to negatively impact potential habitat for *Grevillea juniperina* subsp. *juniperina*:

- infection of native plants by *Phytophthora cinnamomi*
- introduction and establishment of exotic rust fungi of the order pucciniales pathogenic on plants of the family myrtaceae
- invasion and establishment of exotic vines and scramblers
- invasion of native plant communities by African olive O*lea europaea* subsp. c*uspidata*
- invasion of native plant communities by exotic perennial grasses

Mitigation measures outlined in section 5 of the main report have been recommended to decrease the impact of the key threatening process the proposal may indirectly contribute to.

Conclusion

The proposal would result in the loss of 652 individuals of *Grevillea juniperina* subsp. *juniperina* and approximately 2.73 ha of potential habitat in the form of PCT 724 and PCT 835.

The population within the Proposal footprint is considered to form part of a larger local population that includes the Shane's Park saving our species key management site that incorporates both public and private lands and covers about 2,897 hectares (refer to Figure 4.1 in the main report).

As the Proposal footprint will impact on <1% of habitat for the local population of *Grevillea juniperina* subsp. *juniperina*, it is considered unlikely that the proposal would have a significant impact on *Grevillea juniperina* subsp. *juniperina*.

2.3 PULTENAEA PARVIFLORA

2.3.1 STATUS

Pultenaea parviflora is a threatened flora species listed as Endangered under the BC Act and Vulnerable under the EPBC Act.

2.3.2 DESCRIPTION

Grows in dry sclerophyll forest on Wianamatta Shale, laterite or alluvium, Cumberland Plain (Royal Botanic Gardens 2018). It may be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. It can also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.

The dominant canopy is usually *Eucalyptus fibrosa* however *Eucalyptus globoidea, E. longifolia, E. parramattensis, E. sclerophylla* and *E. sideroxylon* may also be present or co-dominant, with *Melaleuca decora* frequently forming a secondary canopy layer.

Associated species may include *Allocasuarina littoralis, Angophora bakeri, Aristida spp. Banksia spinulosa, Cryptandra spp., Daviesia ulicifolia, Entolasia stricta, Hakea sericea, Lissanthe strigosa, Melaleuca nodosa, Ozothamnus diosmifolius and Themeda australis.*

It is often found in association with other threatened species such as *Dillwynia tenuifolia, Grevillea juniperina, Micromyrtus minutiflora* and *Persoonia nutans* (Department of Environment and Conservation 2007).

2.3.3 DISTRIBUTION

Endemic to the Cumberland Plain, its core distribution is from Windsor to Penrith and east to Dean Park. Outlier populations occur at Kemps Creek and Wilberforce (Royal Botanic Gardens 2018).

Recorded occurrences in conservation reserves include:

- Scheyville National Park
- Windsor Downs
- Castlereagh Nature Reserves

2.3.4 SPECIFIC IMPACTS

The proposal would involve impact to of 30 *Pultenaea parviflora* individuals and a total of 2.73 ha of potential habitat.

2.3.5 BC ACT ASSESSMENT

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The proposal would involve the clearing of 30 *Pultenaea parviflora* individuals and 2.73 ha of potential habitat recorded within the Proposal Footprint impact area. This represents 6% of the *Pultenaea parviflora* individuals (498 individuals) previously recorded within locality of the Proposal Footprint (Office of Environment and Heritage, 2018)

As such, the Proposal is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of *Pultenaea parviflora* is likely to be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable

In relation to the habitat of a threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

A total of 2.73 ha of potential habitat for *Pultenaea parviflora* would be impacted by the proposal. The proposal has identified areas which are important for connectivity as Vegetation Exclusion Zones, these areas would not be subject to clearing and encompass 4 *Pultenaea parviflora* individuals and 1.12 ha of potential habitat. As such, the proposal is unlikely to fragment or isolate areas of habitat.

The potential habitat to be impacted includes 2.24 ha of Moderate condition vegetation with >50% of ground strata vegetation is comprised of exotic perennial grasses and 0.49 ha encompasses Poor condition vegetation which occurred as regrowth. The vegetation to be impacted represents <1% of similar habitat (PCT 724; PCT 835) within locality of the proposal (Office of Environment & Heritage 2018).

As the habitat to be removed is considered moderate and low condition and represents a small portion of available habitat within locality, it is unlikely to be important for the long-term survival of the *Pultenaea parviflora.*

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for *Pultenaea parviflora* has been declared under the BC Act. Key management sites have been identified under the Saving Our Species program, none of which are located within the Proposal Footprint (Office of Environment & Heritage 2018).

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Office of Environment and Heritage have identified activities to assist *Pultenaea parviflora* as listed in Table 2.3. The proposal would affect one management activity as 2.73 ha of potential habitat for the species would be impacted.

Table 2.3 Activities to assist *Pultenaea parviflora*

ACTIVITIES TO ASSIST *PULTENAEA PARVIFLORA*	**LIKELY TO BE AFFECTED BY PROPOSAL?**
Fire intervals of 10-15 yrs (where there are no needs for asset protection zones)	No.
Protect areas of known and potential habitat from clearing and further fragmentation.	Yes – The proposal would impact on 2.73 ha of potential habitat
Uncontrolled or poorly-controlled access to sites allows for damage to the plants from recreational vehicle use, and also the dumping of industrial and domestic waste. Fencing and access restriction to sites would minimise this, as would the use of surveillance devices.	No.
There is competition from weeds (both grassy weeds and shrubby weeds) and the perennial grasses in particular can allow the development of too much fuel too quickly.	No.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Proposal directly contributes to the following Key Threatened Processes listed under the BC Act:

- clearing of Native Vegetation (which form potential habitat for *Pultenaea parviflora*)

The Proposal may indirectly contribute to the following additional Key Threatening Processes which have potential to negatively impact potential habitat for *Pultenaea parviflora*:

- infection of native plants by *Phytophthora cinnamomi*
- introduction and establishment of exotic rust fungi of the order pucciniales pathogenic on plants of the family myrtaceae
- invasion and establishment of exotic vines and scramblers
- invasion of native plant communities by African olive O*lea europaea* subsp. c*uspidata*
- invasion of native plant communities by exotic perennial grasses

Mitigation measures outlined in section 5 of the main report have been recommended to decrease the impact of the key threatening process the proposal may indirectly contribute to.

Conclusion

As 6% of *Pultenaea parviflora* (30) individuals known to occur within locality of the Proposal Footprint will be impacted be the Proposal would be removed and the potential habitat to be impacted is considered moderate and low condition and represents a small portion of available habitat within locality, it is unlikely the proposal would have a significant impact on *Pultenaea parviflora.*

2.3.6 EPBC ACT STATUS

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

— lead to a long-term decrease in the size of an important population of a species

The proposal would involve the clearing of 30 *Pultenaea parviflora* individuals recorded within the Proposal Footprint, this represents 6% of individuals (498) previously recorded within locality of the Proposal Footprint (Office of Environment and Heritage, 2018). As the Proposal will impact a small proportion of the local *Pultenaea parviflora* population it is considered unlikely to lead to a long-term decrease in the size of the population.

— reduce the area of occupancy of an important population

A total of 2.73 ha of habitat for *Pultenaea parviflora* would be impacted by the proposal. The potential habitat to be impacted includes 2.24 ha of Moderate condition vegetation with >50% of ground strata vegetation is comprised of exotic perennial grasses and 0.49 ha encompasses of Poor condition vegetation which occurred as regrowth. The vegetation to be impacted represents <1% of similar habitat (PCT 724; PCT 835) within locality of the proposal (Office of Environment & Heritage 2018). As such, the proposal is unlikely to significantly reduce the area of occupancy.

— fragment an existing important population into two or more populations

The 30 individuals which would be impacted by the proposal occur as an isolated local population. This local population is likely to form part of a broader meta population that is partly reserved within Wianamatta Regional Park. Whilst the proposal would result in the loss of 30 individuals it is considered unlikely to fragment an existing important population into two or more populations.

— adversely affect habitat critical to the survival of a species

Critical habitat has not yet been declared for this species under the EPBC Act.

— disrupt the breeding cycle of an important population

The 30 individuals which would be impacted by the proposal occur as an isolated local population which likely form part of a broader meta population that is partly reserved within Wianamatta Regional Park It can be assumed that the individuals to be impacted are genetically isolated from the meta population due to the limited available habitat between populations and the limited dispersal of Fabaceae species. As such it is considered unlikely that the proposal would disrupt the breeding cycle of an important population of *Pultenaea parviflora*.

— modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

A total of 2.73 ha of potential habitat for *Pultenaea parviflora* would be impacted by the proposal. The potential habitat to be impacted includes 2.24 ha of Moderate condition vegetation with >50% of ground strata vegetation is comprised of exotic perennial grasses and 0.49 ha encompasses Poor condition vegetation which occurred as regrowth. The vegetation to be impacted represents <1% of similar habitat (PCT 724; PCT 835) within locality of the proposal and is not considered high quality habitat.

The proposal would involve the removal of 2.73 ha of low quality potential habitat for *Pultenaea parviflora* which is unlikely to impact the species such that the species is likely to decline.

— result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

— introduce disease that may cause the species to decline, or

Mitigation measures outlined in section 5 of the main report have been recommended to minimise the impact of the proposal of threatened species and their habitat. These include hygine protocols to avoid key threatened processes such as *phytophthora cinnamomi*, exotic rust fungi and the invasion and establishment of exotic species.

As such, the proposal is unlikely to result in the introduction or establishment of invasive species or introduce disease that may cause the species to decline.

— interfere substantially with the recovery of the species.

The 30 individuals which would be impacted by the proposal occur as an isolated local population. This local population is likely to form part of a broader meta population that is partly reserved within Wianamatta Regional Park. Though the proposal would

involve the removal of 30 individuals, it can be assumed that these individuals are genetically isolated from the meta population due to the limited available habitat between populations and the limited dispersal of Fabaceae species. As such, it is unlikely these species are important to the meta population or that the proposal is unlikely to interfere substantially with the recovery of *Pultenaea parviflora*.

Conclusion

The proposal would involve the clearing of 30 *Pultenaea parviflora* individuals recorded within the Proposal Footprint, this represents 75% of all individuals recorded during field surveys and 6% of individuals previously recorded within locality (Office of Environment and Heritage, 2018).

A total of 2.73 ha of potential habitat for *Pultenaea parviflora* would be impacted by the proposal. The potential habitat to be impacted includes 2.24 ha of Moderate condition vegetation with >50% of ground strata vegetation is comprised of exotic perennial grasses and 0.49 ha encompasses Poor condition vegetation which occurred as regrowth. The vegetation to be impacted represents <1% of similar habitat (PCT 724; PCT 835) within locality of the proposal and is not considered high quality habitat.

As the Proposal will impact on a small percentage of genetically isolated *Pultenaea parviflora* individuals and a small proportion of potential habitat, it is considered unlikely that the Proposal will have a significant impact on the species.

3 FAUNA

3.1 MICROPCHIROPTERAN BATS

Microchiropteran bats fall into two broad groups based on their roosting requirements, cave-dwelling species and hollow-dependent species. Each group will be dealt with separately within the following test of significance, due to their different roosting habitat preferences.

3.1.1 HOLLOW-DEPENDANT MICROCHIROPTERAN BAT SPECIES

Threatened hollow-dependent species of microchiropteran bat have been assessed together as they generally share similar habitat requirements, threats that affect their recovery, and potential impacts as result of the proposal. Hollow-dependent microchiropteran bats considered for the impact assessment are:

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Freetail Bat (*Micronomus norfolkensis (*syn. *Mormopterus norfolkensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*).

These species have been assessed as a guild because of their similarity in habitat usage and habits, which are described in Table 3.1.

Table 3.1 Details of Threatened species of hollow-dependent microchiropteran bat

COMMON NAME (SCIENTIFIC NAME)	BC ACT[1]	EPBC ACT	HABITAT AND DISTRIBUTION	THREATS
Eastern False Pipistrelle (*Falsistrellus tasmaniensis)*	V	–	Usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings (Churchill 2008).	— Disturbance to winter roosting and breeding sites. — Loss of roosting habitat, primarily hollow-bearing eucalypts. — Loss and fragmentation of foraging habitat, particularly extensive areas of continuous forest and areas of high productivity.
Eastern Freetail Bat (*Micronomus norfolkensis (*syn. *Mormopterus norfolkensis*)	V	–	Thought to live in Sclerophyll forest and woodland. Small colonies have been found in tree hollows or under loose bark. It feeds on insects above the forest canopy or in clearings at the forest edge (Churchill 2008).	— Loss of hollow-bearing trees. — Loss of foraging habitat. — Application of pesticides in or adjacent to foraging areas. — Artificial light sources spilling onto foraging and/or roosting habitat — Large scale wildfire or hazard reduction burns on foraging and/or roosting habitat.
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	–	The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks but it may also forage in rainforest. Typically it forages at a height of 3-6 metres but may fly as low as one metre above the surface of a creek. It feeds on beetles, other large, slow-flying insects and small vertebrates. It generally roosts in tree hollows but has also been found in the roof spaces of old buildings (Churchill 2008).	— Disturbance to roosting and summer breeding sites. — Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions. — Loss of hollow-bearing trees. — Pesticides and herbicides may reduce the availability of insects, or

				result in the accumulation of toxic residues in individuals' fat stores. — Changes to water regimes are likely to impact food resources, as is the use of pesticides and herbicides near waterways.
Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*).	V	–	The Yellow-bellied Sheathtail-bat is a very distinctive, large, insectivorous bat up to 87 mm long. The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	— Disturbance to roosting and summer breeding sites. — Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions. — Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat. — Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores.

(1) V = Vulnerable under the BC Act.

3.1.2 SPECIFIC IMPACTS

The proposal would remove approximately 2.24 ha of potential habitat, in the form of all native vegetation communities with canopy species and including planted native vegetation. In addition to vegetation to be cleared, hollow-bearing trees are expected to be impacted by the proposal. Habitat to be impacted provides foraging, roosting and breeding resources for these species.

3.1.3 BC ACT SIGNIFICANCE ASSESSMENT

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Proposal Footprint contains native vegetation communities that occur as small corridor along the existing Links Road and surrounding infrastructure. Approximately 2.24 ha of vegetation to be impacted provides foraging and roosting for microchiropteran bats, hollow-bearing trees would be removed as part of the proposal and avoidance has been made where possible.

Whilst 2.24 ha of foraging and roosting habitat may be removed as part of the proposal, more intact and likely higher quality roosting opportunities occur in the wider locality in association with Wianamatta Regional Park. Approximately >6,000 ha of potential habitat in the form of native vegetation has been mapped within 10 km of the study, in which would be accessible to these species. The removal of 2.24 ha would represent <1% of available habitat for these species. In addition, the removal of hollow-bearing trees is likely to constitute only a small amount of breeding habitat for these species.

While vegetation to be removed represents foraging opportunities for hollow-dwelling microchiropteran bats, it is considered unlikely that the removal of this vegetation would significantly affect locally occurring microchiropteran bat populations, due to the small scale of the Proposal Footprint and the presence of higher quality habitat in the wider locality.

The Proposal is unlikely to have an adverse effect on the life cycle of hollow-dwelling microchiropteran bats to the point that these species are likely to be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**

Not applicable.

- **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed**

Hollow-bearing trees and 2.24 ha of vegetation representing potential habitat for these species is likely to be affected by the Proposal.

- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action**

Habitat connectivity is not likely to be affected by the proposal. The majority of the vegetation within the Proposal Footprint occurs on previously disturbed land associated with existing road corridor or on marginal vegetation in relation surrounding infrastructure. Approximately 2.24 ha of vegetation is likely to be affected by the Proposal and vegetation removal would be largely limited to previously disturbed areas adjacent to the existing roadside. Consequently, it is considered unlikely that the Proposal would significantly isolate or fragment potential habitat beyond which currently exists within the Proposal Footprint. As the proposal would result in disturbance to linear corridors through disturbed habitat, and given the species high mobility, the Proposal is unlikely to represent significant increases to habitat isolation and or fragmentation.

- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

A relatively small area of potential foraging and roosting habitat (2.24 ha) would be affected by the Proposal. The proposal would not impact habitat considered critical to the long-term survival of populations in the locality and is unlikely to further create a barrier to movement for these species.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Areas of declared critical habitat under the *Threatened Species Conservation Act* 1995, are now labelled as 'Areas of Outstanding Biodiversity Values' (AOBVs) in NSW with the commencement of the *Biodiversity Conservation Act*. The Biodiversity Conservation Regulation 2017 establishes the criteria for declaring AOBVs. The criteria have been designed to identify the most valuable sites for biodiversity conservation in NSW. The Proposal is would not impact any declared AOBVs nor are there any AOBVs identified for these species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

The Office of Environment and Heritage has assigned these species to the landscape species management stream under the Saving our Species program (Office of Environment and Heritage 2017). No priority sites have been identified within the Proposal Footprint or within the locality for any of the mentioned species.

The Proposal is unlikely to have an adverse effect any of recovery actions for any of the mentioned species, with the possible exception of vegetation removal around hollow-bearing trees.

With the implementation of mitigation measures, the proposal would be consistent with the recovery actions for these species. The removal of 2.24 ha of potential habitat is unlikely to significantly affect the recovery of any local population of the species.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

With respect to hollow-dwelling microchiropteran bats, the proposal is consistent with three key threatening processes under the BC Act:

— clearing of native vegetation
— loss of hollow-bearing trees

The extent of native vegetation clearing and habitat removal associated with the proposal is considered relatively small, 2.24 ha of marginal and fragmented habitat. Although the proposal would represent the loss of potential foraging and roosting habitat (hollow-bearing trees), such habitat would only be a small component of locally occurring resources accessible to these species (<1% of available in 10 kms of the Proposal Footprint).

Conclusion

Approximately 2.24 ha potential habitat in the form of remnant woodland and native vegetation containing hollow-bearing trees, which may be used by these species for foraging and roosting purposes is likely to be impacted by the Proposal. Habitat to be impacted occurs as a narrow corridor of vegetation predominantly along Links Road and is in mainly associated with land disturbed by agricultural or industrial use. As the proposal would result in disturbance to linear corridors through predominately disturbed habitat, and given the high mobility of assessed species, the proposal is unlikely to represent significant increases to habitat isolation and or fragmentation. The habitat is not considered critical habitat to long term survival of these species within the locality. Given this, the proposal is considered unlikely to lead to a significant impact on these species their habitat.

3.1.4 CAVE-DWELLING MICROCHIROPTERAN BAT SPECIES

The following cave-dwelling microchiropteran bats were considered to be limited to foraging potential within the Proposal Footprint, due to the lack of suitable cave/artificial roosting opportunities:

— Large-eared Pied Bat (*Chalinolobus dwyeri*)
— Little Bent-wing Bat (*Miniopterus australis*)
— Eastern Bent-wing Bat (*Miniopterus orianae oceanensis*)
— Southern Myotis (*Myotis macropus*).

It should be noted however, given limiting cave roosting opportunities some species are known to utilise hollow-bearing trees (i.e. Southern Myotis) but generally the above-mentioned species do prefer to roosting in caves or artificial structures. These species have been assessed as a guild because of their similarity in habitat usage and habits, which are described in Table 3.2.

Table 3.2 Details of Threatened species of cave-dwelling microchiropteran bat

COMMON NAME (SCIENTIFIC NAME)	BC ACT[1]	EPBC ACT	DISTRIBUTION AND ECOLOGY	THREATS
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	V	Occurs in moderately wooded habitats and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins. Thought to forage below the forest canopy for small flying insects (Churchill 2008).	— Clearing and isolation of forest and woodland habitats near cliffs, caves and old mine workings for agriculture or development. — Loss of foraging habitat close to cliffs, caves and old mine workings from forestry activities and too-frequent burning, usually associated with grazing. — Damage to roosting and maternity sites from mining operations, and recreational caving activities. — Use of pesticides. — Disturbance to roosting areas by goats.
Little Bent-wing Bat (*Miniopterus australis*)	V	–	Feeds on small insects beneath the canopy of well timbered habitats including rainforest, Melaleuca swamps and dry Sclerophyll forests. Roosts in caves and tunnels and has specific requirements for	— Disturbance of colonies, especially in nursery or hibernating caves, may be catastrophic. — Destruction of caves that provide seasonal or potential roosting sites.

			nursery sites. Distribution becomes coastal towards the southern limit of its range in NSW. Nesting sites are in areas where limestone mining is preferred (Strahan 1995).	— Changes to habitat, especially surrounding maternity/nursery caves and winter roosts. — Pesticides on insects and in water consumed by bats bio accumulates, resulting in poisoning of individuals. — Predation from foxes, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges. — Predation from feral cats, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges — Introduction of exotic pathogens such as the White-nosed fungus. — Hazard reduction and wildfire fires during the breeding season. — Large scale wildfire or hazard reduction can impact on foraging resources. — Poor knowledge of reproductive success and population dynamics.
Eastern Bent-wing Bat (*Miniopterus orianae oceanensis*)	V	–	Distributed across the east coast of Australia, rests in caves, old mines, stormwater channels and comparable structures including occasional buildings (Dwyer 1998). Typically found in well-timbered valleys where it forages, above tree canopy on small insects (Churchill 2008).	— Disturbance by recreational cavers and general public accessing caves and adjacent areas particularly during winter or breeding. — Loss of high productivity foraging habitat. — Introduction of exotic pathogens, particularly white-nose fungus. — Cave entrances being blocked for human health and safety reasons, or vegetation (particularly blackberries) encroaching on and blocking cave entrances. — Hazard reduction and wildfire fires during the breeding season.
Southern Myotis *(Myotis macropus*)	V	–	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10–15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	— Loss or disturbance of roosting sites. — Clearing adjacent to foraging areas. — Application of pesticides in or adjacent to foraging areas. — Reduction in stream water quality affecting food resources.

			In NSW females have one young each year usually in November or December.	

(1) V = Vulnerable under the BC Act.

3.1.5 SPECIFIC IMPACTS

The proposal would impact approximately 2.24 ha of potential habitat in the form of native sclerophyll woodland on the verges of the existing Links Road and industrial complexes. No significant breeding or roosting habitat (i.e. caves or artificial structures) would be impacted by the proposal. In relation to Southern Myotis, marginal foraging habitat (small stream) would be impacted by the proposal.

3.1.6 BC ACT SIGNIFICANCE ASSESSMENT

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

No roosting opportunities within the Proposal Footprint for cave-dwelling microchiropteran bat species were identified during field investigations. Significant roost sites used by cave-dwelling microchiropteran bats are often large with deep connecting tunnels or crevices; have restricted airflow to maintain humidity and have the presence of standing water (Department of Environment and Conservation 2004). No significant roost sites were identified in the Proposal Footprint.

There are foraging opportunities for these species associated with remnant vegetation, throughout the Proposal Footprint and in the wider locality. Only a relatively small area of foraging habitat (2.24 ha) would be affected by the proposal. These species often prefer to forage along the ecotonal edges between open and wooded habitats and these types of foraging opportunities would continue to exist throughout the Proposal Footprint and wider locality. Large of habitat available occurs within the locality (approximately >6,000 ha within 10kms of the Proposal Footprint), the impact of 2.24 ha would represent a loss of <1% of potential habitat for these species.

Therefore, the proposal is unlikely to cause significantly adverse effects upon cave-dwelling microchiropteran bat species, due to the relatively small area of vegetation removed (2.24 ha) and absence of any significant cave-dwelling roosts within the Proposal Footprint.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

— **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**

Not applicable.

— **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

— **the extent to which habitat is likely to be removed or modified as a result of the action proposed**

Potential foraging habitat for cave-dwelling microchiropteran bat species was recorded within the Proposal Footprint during field surveys. Approximately 2.24 ha of foraging habitat is likely to be affected by the proposal. No significant roosting habitat would be impacted due to the proposal.

— **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action**

While the Proposal Footprint occurs in predominantly disturbed land, proposed vegetation removal would be largely limited to areas of potential foraging habitat along the edges of existing breaks in remnant vegetation stands. As the proposal would result in disturbance to linear corridors through predominately disturbed habitat, and given the species high mobility, the Proposal is unlikely to significant increase habitat isolation and or fragmentation.

— **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The Proposal Footprint provided a relatively small amount of potential foraging habitat for these species. The removal of 2.24 ha potential foraging habitat would present <1% of available habitat (in form of native vegetation communities) for these species. Foraging opportunities occurring within the Proposal Footprint, such as ecotonal zones, would continue to exist and an abundance of similar and potential higher quality foraging opportunities would remain available the wider locality. The Proposal would not impact habitat considered important to the long-term survival of populations in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Areas of declared critical habitat under the *Threatened Species Conservation Act* 1995, are now labelled as 'Areas of Outstanding Biodiversity Values' (AOBVs) in NSW with the commencement of the *Biodiversity Conservation Act*. The *Biodiversity Conservation Regulation* 2017 establishes the criteria for declaring AOBVs. The criteria have been designed to identify the most valuable sites for biodiversity conservation in NSW. The Proposal would not impact any declared AOBVs nor are there any AOBVs identified for these species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

The Office of Environment and Heritage has assigned these species to the landscape species management stream (except Large-eared Pied Bat which is data-deficient) under the Saving our Species program (Office of Environment and Heritage 2017). No priority sites have been identified within the Proposal Footprint or within the locality for any of the mentioned species. The proposal is unlikely to have an adverse effect any of these recovery actions. The removal of 2.24 ha of potential habitat is unlikely to significantly affect the recovery of any local population of the species.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A Key Threatening Process means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Key threatening processes are listed under the BC Act.

With respect to cave-dwelling microchiropteran bats, the Proposal is consistent with one KTP, being clearing of native vegetation. This KTP is not likely to significantly affect these species in the locality given the relatively small area to be cleared and the availability of similar, higher quality habitat in the wider locality. A threat abatement plan has not been prepared for this process.

Conclusion

While the Proposal Footprint provides potential foraging resources for cave-dwelling microbat species the majority of the Proposal Footprint has been previously disturbed by the existing road verge from agricultural or industrial development. Vegetation clearance would be small in size, with 2.24 ha of potential habitat likely to be affected. No significant roosting habitat would be impacted due to the proposal.

The Proposal is unlikely to lead to a significant impact on cave-dwelling microchiropteran bats or their habitats.

3.1.7 EPBC ACT SIGNIFICANCE ASSESSMENT FOR LARGE-EARED PIED BAT

The Large-eared Pied Bat *(Chalinolobus dwyeri)* is listed as Vulnerable under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1. Under the Act, important populations are:

— likely to be key source populations either for breeding or dispersal
— likely to be necessary for maintaining genetic diversity
— at or near the limit of the species range.

Is this part of an important population?

The Large-eared Pied Bat has scattered records within the locality of the Proposal Footprint. The Large-eared Pied Bat occurs across a wide range of different vegetation contexts, from rainforest edges and the wet sclerophyll forests of the coast and ranges to dry woodlands and Callitris pine dominant woodlands west of the divide. What is of most importance to this species is the presence of escarpments and rocky outcroppings in association with the above vegetation types, which provide caves and crevices for roosting and breeding purposes. The Proposal Footprint does not provide any significant roosting/breeding opportunities. The site predominately provides foraging opportunities, due to the presence of insect attracting canopy foliage, such habitat occurs widely within the the wider locality (e.g. Wianamatta Regional Park). Consequently, foraging and roosting resources within the study area are not considered critical to maintaining populations.

Potential occurrences of this species within the Proposal Footprint are not at the limits of the species' distribution and as such the potential habitat recorded can only be considered to represent a small part of the foraging range of widely occurring individuals. For these reasons, if present within the site, individuals of this species would not be considered to be part of an important population.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following:

— **Lead to a long-term decrease in the size of an important population of a species**

Not applicable. Large-eared Pied Bat in the Proposal Footprint is not part of an important population (refer to above).

— **Reduce the area of occupancy of an important population**

Not applicable. Large-eared Pied Bat in the Proposal Footprint is not part of an important population (refer to above).

— **Fragment an existing important population into two or more populations**

Not applicable. Large-eared Pied Bat in the Proposal Footprint is not part of an important population (refer to above).

— **Adversely affect habitat critical to the survival of a species**

No critical habitat is listed for this species under the EPBC Act.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

— for activities such as foraging, breeding, roosting, or dispersal
— for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
— to maintain genetic diversity and long-term evolutionary development
— for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment Water Heritage and the Arts 2009).

The proposal would impact approximately 2.24 ha of suitable foraging habitat only for this species. No potential roosting or breeding habitat was identified in the Proposal Footprint. The impact of 2.24 ha of potential foraging habitat would only constitute a small amount (<1%) of available habitat for this species. As a result, it is unlikely that the impact of 2.24 ha of potential habitat would be classified as critical habitat for the species.

— **Disrupt the breeding cycle of an important population**

Not applicable. Large-eared Pied Bat in the Proposal Footprint is not part of an important population (refer to above).

— **Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The proposal would affect a small extent (2.24 ha) of suitable foraging habitat. No significant roosting or breeding habitat occurs within the Proposal Footprint. The proposal is not likely to significantly affect the availability of quality habitat for this species.

— **Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

The proposal is not likely to increase the likelihood of an invasive species becoming established in the habitat of the Large-eared Pied Bat.

— **Introduce disease that may cause the species to decline**

The proposal is not likely to increase the likelihood of a disease becoming established or proliferating in a local population that would result in a decline of the Large-eared Pied Bat.

— **Interfere substantially with the recovery of the species**

Due to the small amount of foraging habitat likely to be affect by the proposal (2.24 ha) and no impact to roosting/breeding habitat, the proposal is not likely to interfere with the recovery of this species.

Conclusion

The Large-eared Pied Bat forages across a wide range of vegetation types, including those within the Proposal Footprint. However cave or rocky outcrops which offer roosting and breeding caves/crevices are of prime importance to the viability and maintenance of 'important populations' and these habitat attributes do not occur in the Proposal Footprint. Although a relatively small area of potential foraging habitat would be removed (2.24 ha), there is an abundance of similar and potentially higher quality habitat elsewhere within the wider locality. As a consequence, foraging habitat to be removed is not considered to be significant to this species. Therefore, the Proposal is unlikely to lead to a significant impact on the Large-eared Pied bat or their habitats.

3.2 WOODLAND BIRDS

Dusky Woodswallow *(Artamus cyanopterus),* Varied Sittella *(Daphoenositta chrysoptera),* Speckled Warbler (*Chthonicola sagittata (syn. Pyrrholaemus sagittatus)),* Glossy Black-cockatoo (*Calyptorhynchus lathami*) have been grouped for assessment owing to their similar preference for open woodland habitat. These four threatened woodland birds generally share similar habitat requirements; threats that affect their recovery; and potential impacts because of the proposal (refer Table 3.3). All species are listed as Vulnerable under the BC Act.

Table 3.3 Details of threatened woodland birds

COMMON NAME (SCIENTIFIC NAME)	BC ACT	EPBC ACT	HABITAT AND DISTRIBUTION	THREATS
Dusky Woodswallow (*Artamus cyanopterus)*	V	–	The Dusky Woodswallow is widespread in eastern, southern and southwestern Australia. In NSW, it is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. Often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. Also recorded in shrublands and heathlands and various modified habitat, including regenerating forest; very occasionally in moist forest or rainforests(Higgins and Peter 2002).	— Apparent decline has been attributed to declining habitat — Poor regeneration of open forest and woodland habitats due to habitat removal and modification — Aggressive exclusion by Noisy Miner — Inappropriate fire regimes.
Speckled Warbler (*Chthonicola sagittata (syn. Pyrrholaemus sagittatus))*	V	–	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100ha survive. Lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees.	— Due to the fragmented nature of the populations and their small size the species is susceptible to catastrophic events and localised extinction. — Clearance of remnant grassy woodland habitat for paddock management reasons and for firewood. — Modification and destruction of ground habitat through removal of litter and fallen timber, introduction of exotic pasture grasses, heavy grazing and compaction by stock and frequent fire. — Habitat is lost and further fragmented as land is being cleared for residential and agricultural developments. In particular, nest predation increases significantly, to nest failure rates of over 80%, in isolated fragments. — Nest failure due to predation by native and non-native birds, cats, dogs and foxes particularly in fragmented and degraded habitats. — Infestation of habitat by invasive weeds.
Varied Sittella	V	–	The Varied Sittella inhabits most of mainland Australia except the treeless	— Habitat clearing and isolation

(*Daphoenositta chrysoptera)*			deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (Office of Environment & Heritage 2016)	— Reductions in tree species diversity, tree canopy cover, shrub cover, ground cover, logs, fallen branches and litter. — Dominance of Noisy Miners (*Manorina melanocephala*). in woodland patches — Habitat degradation through small-scale clearing for fence lines and road verges, and firewood collection.
Glossy Black-cockatoo (*Calyptorhynchus lathami*)	V	-	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. Feeds almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina* species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites (Office of Environment & Heritage 2015).	— Reduction of suitable habitat through clearing for development. — Decline of hollow bearing trees over time due to land management activities. — Excessively frequent fire which eliminates sheoaks from areas, prevents the development of mature sheoak stands, and destroys nest trees. — Firewood collection resulting in loss of hollow bearing trees, reduced recruitment of hollow bearing trees, and disturbance of breeding attempts. — Decline in extent and productivity of sheoak foraging habitat due to feral herbivores. — Limited information on the location of nesting aggregations and the distribution of high quality breeding habitat. — Disturbance from coal seam gas and open cut coal mining causing loss of foraging and breeding habitat as well as disturbing reproductive attempts. — Forestry activity resulting in loss of hollow bearing trees, reduced recruitment of hollow bearing trees, degradation of foraging habitat, and disturbance of breeding attempts. — Decline in extent and productivity of sheoak foraging habitat caused by moisture stress due to climate change. — Degradation of foraging habitat and reduced regeneration of sheoak stands due to grazing by domestic stock. — Loss of foraging habitat due to slashing/underscrubbing.

				— Change in the spatial and temporal distribution of foraging resources due to global warming. — Habitat infestation by weeds such as African boxthorn, Gazania, buffel grass and other invasive grasses.

3.2.1 SPECIFIC IMPACTS

No threatened woodland birds were observed during the field surveys; however approximately 2.24 ha of potential habitat including hollow-bearing trees for threatened woodland birds listed above may be impacted as a result of this proposal.

3.2.2 BC ACT SIGNIFICANCE ASSESSMENT

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Approximately 2.24 ha of potential habitat in narrow linear patches would be affected by the proposal, including a small amount of hollow-bearing trees. This habitat provides potential foraging, roosting and breeding resources for these species. This area is only a very small portion of the available habitats in the area, within a 10 km area from the proposal approximately >6,000 ha of potential habitat occurs. Impact to 2.24 ha of potential would represent <1% of available habitat for these species within 10 km. The majority of the Proposal Footprint is confined to previously disturbed lands, with a relatively small amount of suitable habitat likely to be affected. Consequently, the proposal is considered unlikely to impact threatened woodland birds such that a viable local population is placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

— **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable

— **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

— **the extent to which habitat is likely to be removed or modified as a result of the action proposed**

It is estimated that approximately 2.24 ha of potential woodland bird habitat would be affected by the proposal. However, local populations of these species are not restricted to habitat resources contained within the Proposal Footprint due their mobility and the availability of similar and higher quality habitat resources within the greater locality.

— **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**

Habitat connectivity is unlikely to be affected by the proposal. Available threatened woodland bird habitat in the locality is already fragmented by agriculture, existing infrastructure, and residential development. It is unlikely that the proposal would contribute significantly to the fragmented state of woodland bird habitat, however it would add incrementally to the disturbance of available habitat for these species within the Proposal Footprint.

— **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The proposal would not create a significant barrier to the movement of these species between areas of suitable habitat. The impact of 2.24 ha of potential habitat would present <1% of available habitat within 10 km of the Proposal Footprint. Higher quality habitat within the locality would still be accessible for these species. The quality and importance of habitat which may be impacted by activities is not considered to be significantly important for the long term survival of any local population of these species.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Areas of declared critical habitat under the *Threatened Species Conservation Act* 1995, are now labelled as 'Areas of Outstanding Biodiversity Values' (AOBVs) in NSW with the commencement of the *Biodiversity Conservation Act*. The *Biodiversity Conservation Regulation* 2017 establishes the criteria for declaring AOBVs. The criteria have been designed to identify the most valuable sites for biodiversity conservation in NSW. The Proposal would not impact any declared AOBVs nor are there any AOBVs identified for these species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan has been developed for threatened woodland birds, as produced under the BC Act. In the interim however, the Office of Environment and Heritage has identified landscape management actions to help recover threatened woodland birds. The proposal is unlikely to cause significant impacts with any management actions, however, removal of vegetation would breach some recovery actions including: retention of existing vegetation and remnant stands along roadsides; retention of dead timber on the ground and retention of protected woodland from habitat clearing. However, as part of the mitigation measures, recommended actions will be put in place to alleviate the breaches of recovery actions, these will include:

— retention of existing vegetation where possible
— salvage of dead timber from proposal footprint into adjacent habitat to provide ground habitat
— control of weeds and exotic flora within retained vegetation
— implement buffer zones around vegetation stands where possible; and
— revegetation and habitat restoration in disturbed areas to re-establish corridor links and increase existing vegetation remnants where possible.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to threatened woodland birds, the proposal is consistent with two key threatening processes, being clearing of native vegetation and removal of dead wood and dead trees. The extent of native vegetation clearing and habitat removal associated with the proposal is relatively small in terms of the available habitat for these species within the proposal locality. In addition, mitigation measures are recommended for revegetation, habitat restoration and timber salvaging to ensure that impacts would be minor.

Conclusion

No threatened woodland birds were recorded during surveys. Approximately 2.24 ha of potential habitat would be affected by the proposal. Similar habitats of equal or greater quality would remain within and surrounding the proposal footprint. Populations, if present, are considered to be small patches of a larger metapopulation. The proposal is unlikely to increase fragmentation any greater than that currently occurring in the Proposal Footprint and wider locality. Habitats for threatened woodland birds of similar or greater quality would remain in proximity the Proposal Footprint and wider locality. Based on the above assessment, threatened woodland birds are unlikely to be significantly impacted by the proposal.

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3.3 BLOSSOM NOMADS

Little Lorikeet (*Glossopsitta pusilla*) and Grey-headed Flying-fox (*Pteropus poliocephalus*) have been grouped for assessment owing to generally sharing similarities habitat and feeding preference. Under the BC Act, Little Lorikeet and Grey-headed Flying-fox are listed as Vulnerable. Under the EPBC Act the Grey-headed Flying-fox is listed as Vulnerable.

Table 3.4 Details of threatened opportunistic blossom nomads

COMMON NAME (SCIENTIFIC NAME)	BC ACT	EPBC ACT	HABITAT AND DISTRIBUTION	THREATS
Little Lorikeet (*Glossopsitta pusilla)*	V		The Little Lorikeet is a small green lorikeet with black bill and red patch on forehead and throat. The underside is yellow-green. Immatures are duller with less red on face and brown bill. Found in forests, woodland, treed areas along watercourses and roads. Forages mainly on flowers, nectar and fruit. Found along coastal east Australia from Cape York in Queensland down east coast and round to South Australia. Uncommon in southern Victoria (Higgins 1999).	— Extensive clearing of woodlands for agriculture has significantly decreased food for the lorikeet. — Small scale clearing, destroys habitat and foraging sites. — Loss of hollow bearing trees has reduced nest sites, and increased competition with other native and exotic species for nest sites. — Competition with the introduced Honeybee for both nectar and hollows.
Grey-headed Flying Fox	V	V	Occurs in the coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. However, only a small proportion of this range is used at any one time, as the species selectively forages where food is available. As a result, patterns of occurrence and relative abundance within its distribution vary widely between seasons and between years. At a local scale, the species is generally present intermittently and irregularly. At a regional scale, broad trends in the distribution of plants with similar flowering and fruiting times support regular annual cycles of migration. Whilst Brisbane, Newcastle, Sydney and Melbourne are occupied continuously, elsewhere, during spring, Grey-headed Flying-foxes are uncommon south of Nowra and widespread in other areas of their range. The species is widespread throughout their range in summer, whilst in autumn it occupies coastal lowlands and is uncommon inland. In winter, the species congregrates in coastal lowlands north of the Hunter Valley and is occasionally found on the south coast of NSW (associated with flowering Spotted Gum *Corymbia maculata*) and on the northwest slopes (generally associated with flowering White Box *Eucalyptus albens* or Mugga Ironbark (*E. sideroxylon*). Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting	— Protect roost sites, particularly avoid disturbance September through November. — Identify and protect key foraging areas. — Manage and enforce licensed shooting. — Investigate and promote alternative non-lethal crop protection mechanisms. — Identify powerline blackspots and implement measures to reduce deaths; implement measures to reduce deaths from entanglement in netting and on barbed-wire. — Increase public awareness/understanding about flying-foxes, and their involvement in flying-fox conservation. — Monitor the national population's status and distribution. — Improve knowledge on demographics and population structure to better understand ecological requirements of the species.

			camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines (Office of Environment & Heritage 2015) (Department of the Environment 2016).	

3.3.1 SPECIFIC IMPACTS

The proposal would affect approximately 2.36 ha of potential foraging habitat for these opportunistic blossom nomads. Potential foraging habitat was observed in the form of native plantings and dry sclerophyll woodland differing in overall quality.

3.3.2 BC ACT SIGNIFICANCE ASSESSMENT

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Approximately 2.36 ha of potential habitat is likely to be affected by the proposal. Although the proposal would represent the loss of potential foraging habitat, the Proposal Footprint would only be a small component of locally occurring resources that would be accessible to these species. Thus, the proposal is not considered likely to impact blossom nomads such that a viable local or intermittent seasonal population would be placed at a significant risk of extinction.

The Little Lorikeet could possibly utilise the vegetation within the Proposal Footprint for breeding in the form of hollow-bearing trees, however a negligible amount would be impacted by the proposal. The Grey-headed Flying-fox usually setup roosting camps in association with blossom availability, which are usually situated in dense vegetation and associated with water. No roost camps were located in the Proposal Footprint.

The proposal would remove vegetation along a corridor associated mainly with Links Road. Considering the mobile nature of these species, this action is unlikely to isolate the species habitat significantly. Given the scale at which the proposal is to impact (2.36 ha), it is unlikely that the proposal would have an adverse effect on the life cycle of this species, such that a viable local populations is to be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

- **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed**

Approximately 2.36 ha of suitable habitat would be affected by the proposal.

— **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action**

Habitat connectivity is not likely to be affected by the proposal. The majority of the Proposal Footprint occurs in a previously disturbed and modified landscape (industrial and agricultural). Approximately 2.36 ha of foraging habitat is likely to be affected by the proposal with vegetation removal largely limited to a linear disturbance corridor. The proposal would not significantly exacerbate fragmentation compared to what already exists due to previous development. Furthermore, given that blossom nomad species are highly mobile, the proposal would not present a significant barrier to these species. It is considered unlikely that habitat would become further isolated or fragmented significantly beyond that currently existing in the Proposal Footprint.

— **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

Within a 10 km area of the proposal >6,000 ha of potential foraging occurs as native vegetation communities. These species would not only be limited to this area but to a much greater region. Therefore, the extent of potential habitat (2.36 ha) to be removed represents a small proportion (<1%) of habitat available within the locality and surrounding landscape. Owing to the small extent of potential habitat likely to be affected, the proposal is unlikely to affect the long-term survival of these species.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Areas of declared critical habitat under the *Threatened Species Conservation Act* 1995, are now labelled as 'Areas of Outstanding Biodiversity Values' (AOBVs) in NSW with the commencement of the *Biodiversity Conservation Act*. The *Biodiversity Conservation Regulation* 2017 establishes the criteria for declaring AOBVs. The criteria have been designed to identify the most valuable sites for biodiversity conservation in NSW. The Proposal is would not impact any declared AOBVs nor are there any AOBVs identified for these species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

OEH is currently developing a targeted approach for managing landscape species including the Little Lorikeet. In the interim, the management actions have been identified for this species. The proposal would not be inconsistent with these actions and it is unlikely the proposal would impede the recovery of the Little Lorikeet.

The Office of Environment and Heritage has identified 31 management actions for the Grey-headed Flying-fox. The proposal is likely to be in conflict with one management action, being increasing the extent and viability of foraging habitat that is productive during winter and spring, including rehabilitation/restoration works.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to threatened blossom nomads, the proposal is consistent with three key threatening processes under the BC Act:

— clearing of native vegetation
— loss of hollow-bearing trees (in the case of the Little Lorikeet only in the locality)
— removal of dead wood and trees.

The extent of native vegetation clearing and habitat removal associated with the proposal is considered relatively small in terms of the available habitat for these species within the surrounding landscape, although it is considered to be an incremental loss of suitable habitat locally.

Conclusion

The proposal would affect approximately 2.36 ha of suitable foraging habitat for these opportunistic blossom nomads. Potential foraging habitat was observed in the form of native vegetation communities differing in overall quality.

The extent of native vegetation clearing and habitat removal associated with the proposal is small in terms of the available habitat (removal of <1% in 10 km^2) for these species within the surrounding landscape. Although the loss of foraging habitat for blossom nomads is considered to be an incremental loss of suitable habitat locally, the proposal is not likely to have a significant impact upon these species that might lead to their extinction locally.

3.3.3 EPBC ACT SIGNIFICANCE ASSESSMENT FOR GREY-HEADED FLYING-FOX

The Grey-headed Flying-fox is listed as Vulnerable under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of the Environment 2013). Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity
- at or near the limit of the species range.

Is this part of an important population?

Grey-headed Flying-foxes occur across a range of wooded habitats where their favoured food, eucalypt blossom occurs. They set up roosting camps in association with blossom availability, which are usually situated in dense vegetation and associated with water. Grey-headed Flying-foxes can migrate up to 75 km north during the winter and during this time young flying-foxes establish camps.

The Proposal footprint does not contain suitable habitat for roosting camps and such habitat does not occur within its close vicinity. Therefore, a population of Grey-headed Flying-fox in the Proposal footprint is not considered to be important, as no roost sites would be affected by the proposal.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following:

- **Lead to a long-term decrease in the size of an important population of a species**

Not applicable. Grey-headed Flying-fox occurring in the in the Proposal Footprint is not part of an important population.

- **Reduce the area of occupancy of an important population of the species**

Not applicable. Grey-headed Flying-fox occurring in the in the Proposal Footprint is not part of an important population.

- **Fragment an existing important population into two or more populations**

Not applicable. Grey-headed Flying-fox occurring in the in the Proposal Footprint is not part of an important population.

- **Adversely affect habitat critical to the survival of a species**

No critical habitat is listed for this species under the EPBC Act.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment and Heritage 2006a).

The proposal would remove about 2.36 ha of suitable foraging habitat for this species. As this species is highly mobile, with individuals foraging up to 50 km from roost sites, it is likely that suitable foraging resources could be accessed in the locality. Therefore, this would not meet the above criteria.

- **Disrupt the breeding cycle of an important population**

Not applicable. Grey-headed Flying-fox occurring in the in the Proposal Footprint is not part of an important population.

- **Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

No. The proposal would only affect approximately 2.36 ha of suitable foraging habitat for this species. As this species is known to forage up to 50 km from roost sites, the proposal is not likely to significantly affect the availability of quality habitat for this species.

— **Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species´ habitat**

It unlikely that invasive species (such as introduced predators) that are harmful to the Grey-headed Flying-fox would become further established as a result of the proposal.

— **Introduce disease that may cause the species to decline**

No. There are no known diseases that are likely to increase in the area as a result of the proposal.

— **Interfere with the recovery of the species**

Due to the limited foraging habitat likely to be affect by the proposal (about 2.36 ha) and as no roost camps are located in the vicinity of the Proposal Footprint, the proposal is unlikely to interfere with the recovery of this species.

Conclusion

The Grey-headed Flying-fox frequents habitats that contain eucalypt blossom and native fruits such as figs, which are their favoured foods. The Proposal footprint contains a number of eucalypt dominated communities, these include those that are favoured by this species. A small amount of potentially suitable foraging habitat (2.36 ha) would be affected by the proposal, although this is unlikely to be significant to local populations, due to the abundance of similar and greater quality foraging habitat elsewhere within the Proposal Footprint and in the wider locality. There were no Grey-headed Flying-fox camps within the Proposal footprint or its vicinity, but there are camps in the wider region. Therefore, habitat attributes occurring within the Proposal footprint are not considered important to the long-term survival of the Grey-headed Flying-fox.

3.4 RAPTORS

The Little Eagle (*Hieraaetus morphnoides*) and Square-tailed Kite (*Lophoictinia isura*) have been grouped for assessment owing to family similarities and overlap in ecology and habitat preferences. Details of each species are given below (refer Table 3.5). The Little Eagle and the Square-tailed Kite are listed as Vulnerable under the BC Act.

Table 3.5 Details of threatened raptors

COMMON NAME (SCIENTIFIC NAME)	BC ACT	EPBC ACT	HABITAT AND DISTRIBUTION	THREATS
Little Eagle (*Hieraaetus morphnoides*)	V	–	The Little Eagle is distributed throughout the Australian mainland occupying habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet (Marchant and Higgins 1993).	— Further clearing and degradation of foraging and breeding habitat. — Loss of breeding sites — Competition with the larger and more dominant Wedge-tailed Eagle.
Square-tailed Kite *Lophoictinia isura*)	V	–	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.(Garnett and Crowley 2000, Office of Environment & Heritage 2014).	— Clearing, logging, burning, and grazing of habitats resulting in a reduction in nesting and feeding resources. — Disturbance to or removal of potential nest trees near watercourses. — Illegal egg collection and shooting.

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3.4.1 SPECIFIC IMPACTS

These species were not recorded during surveys. However, approximately 2.36 ha of potential habitat was recorded in the Proposal footprint in the form of native vegetation communities.

3.4.2 BC ACT SIGNIFICANCE ASSESSMENT

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Threatened raptors were not recorded in the study area during surveys. Approximately 2.36 ha of foraging habitat, is likely to be affected by the proposal. Due to the mobility and large home range of these species, and the linear footprint of this proposal, it unlikely to affect their life cycle or their ability to forage and breed. Any identified population of threatened raptors would not be restricted to habitat within the study area, as similar and likely better quality habitat occurs widely in the locality. Within a 10km area of the proposal approximately >6,000 ha of native vegetation communities would be accessible to these species for foraging. The impact of 2.36 ha of potential habitat would represent <1% of habitat in the 10kms of the proposal. It is likely that these species would also utilise greater habitat further abroad.

Although the proposal would represent the loss of potential foraging habitat, such habitat would only be a small component of locally occurring resources accessible to these species, and it is unlikely to constitute important habitat that if impacted, would have an adverse effect on the life cycle of these species.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

- **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The proposal is likely to affect approximately 2.36 ha of potential foraging habitat in the form of native vegetation for these species.

Habitat connectivity is unlikely to be affected by the proposal. The Proposal footprint is mostly confined to previously disturbed areas and clearing would largely be limited to a linear corridor. The proposal would not adversely fragment or isolate any previously undisturbed patches of habitat. Furthermore, given these species' high mobility and that similar and likely more significant habitat occurs widely in the locality, it is considered unlikely that habitat would become further isolated or fragmented significantly beyond that currently existing in the Proposal footprint.

A relatively small area of native vegetation (2.36 ha) providing potential foraging habitat would be affected by the proposal. Foraging opportunities would continue to exist and an abundance of similar and better quality foraging opportunities would be retained both within the Proposal footprint and wider locality. Owing to the relatively small extent of potential native vegetation

(2.36 ha) to be affected and the vast abundance of habitat in the locality, the proposal is unlikely to significantly affect their long-term survival, although the loss of native vegetation habitat must considered to be an incremental loss of local habitat.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Areas of declared critical habitat under the *Threatened Species Conservation Act* 1995, are now labelled as 'Areas of Outstanding Biodiversity Values' (AOBVs) in NSW with the commencement of the *Biodiversity Conservation Act*. The *Biodiversity Conservation Regulation* 2017 establishes the criteria for declaring AOBVs. The criteria have been designed to identify the most valuable sites for biodiversity conservation in NSW. The proposal would not impact any declared AOBVs nor are there any AOBVs identified for these species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan has been prepared for threatened raptors under the BC Act. The Office of Environment and Heritage has assigned both species as Landscape management species under the *Saving our Species* program. The Office of Environment and Heritage has identified a number of management actions for the recovery of each of these species.

The proposal is unlikely to adversely affect the recovery of these species, mitigation measures imposed will be consistent with the management actions.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect these species, the proposal is consistent with one key threatening process, being clearing of native vegetation. The extent of native vegetation clearing and habitat removal associated with the proposal is considered relatively small (2.36 ha) in terms of the available habitat for these species within the surrounding landscape, although it is considered to be an incremental loss of suitable habitat locally.

Conclusion

Approximately 2.36 ha of potential habitat would be impacted due to the proposal. Owing to the relatively small extent of potential native vegetation to be affected and the abundance of habitat in the locality, the disturbance of this habitat is unlikely to adversely affect these species. Although the loss of habitat would represent an incremental loss of potentially suitable habitat, the proposal is unlikely to have a significant impact upon these species.

3.5 POWERFUL OWL

Table 3.6 Details of threatened large forest owls

COMMON NAME (SCIENTIFIC NAME)	BC ACT	EPBC ACT	HABITAT AND DISTRIBUTION	THREATS
Powerful Owl (*Ninox strenua*)	V	–	A sedentary species with a home range of approximately 1000 hectares it occurs within open eucalypt, Casuarina or Callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands (Garnett and Crowley 2000).	Historical loss and fragmentation of suitable forest and woodland habitat from land clearing for residential and agricultural development. This loss also affects the populations of arboreal prey species, particularly the Greater Glider which reduces food availability for the Powerful Owl. Inappropriate forest harvesting practices that have changed forest structure and removed old growth hollow-bearing trees. Loss of hollow-bearing trees reduces the availability of suitable nest sites and prey habitat. Can be extremely sensitive to disturbance around the nest site, particularly during pre-laying, laying and downy chick stages. Disturbance during the breeding period may affect breeding success. High frequency hazard reduction burning may also reduce the longevity of individuals by affecting prey availability. Road kills. Secondary poisoning. Predation of fledglings by foxes, dogs and cats.

3.5.1 SPECIFIC IMPACTS

This species was not recorded during surveys informing this report. However, approximately 2.36 ha of potential habitat was recorded in the Proposal footprint, which consisted of native vegetation communities including native plantings and dry sclerophyll woodland. In addition, a small amount of hollow-bearing trees would be impacted as part of the proposal, however during field surveys none displayed the required characteristics preferred by the species for breeding.

3.5.2 BC ACT SIGNIFICANCE ASSESSMENT

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Powerful Owl was not recorded in the study area during field surveys. A relatively small amount of potentially suitable habitat (approximately 2.36 ha), is likely to be affected by the proposal. The Proposal footprint largely only contained moderate to poor quality habitat occurring as disturbed habitat and a small number of hollow-bearing trees.

Due to the mobility, large home range and the linear nature of the proposal, potential habitat occurring within the Proposal footprint would likely to be utilised as part of a larger home range for individuals. Any identified population of forest owls would not be restricted to habitat within the study area corridor, as similar and likely better quality habitat occurs widely in the locality.

Within 10 km from the proposal, approximately 6,500 ha of native vegetation communities representing potential habitat for these species occurs. The loss of 2.36 ha would represent a loss of <1% of available habitat within 10 km of the proposal. Although the proposal would represent the loss of potential habitat (including foraging habitat), such habitat would only be a small component of locally occurring resources accessible to these species, and it is not likely to constitute important habitat that if impacted, would have an adverse effect on the life cycle of these species.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable

- **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable

In relation to the habitat of a threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The proposal is likely to affect approximately 2.36 ha of potential foraging habitat for the species.

Habitat connectivity is not likely to be affected by the proposal. The majority of the proposal occurs within a previously disturbed road corridor and within disturbed environment (i.e. urban and agricultural lands). Vegetation removal would largely be limited to a small linear corridor. As the proposal is largely confined to previously disturbed areas, the proposal would not significantly further fragment or isolate any previously undisturbed patches of habitat than what already exists. Furthermore, given these species' high mobility (some using home ranges up to 1500 ha) and that similar and likely more significant habitat occurs widely in the locality, it is not considered likely that habitat would become further isolated or fragmented significantly beyond that currently existing in the study area and wider locality.

A relatively small (2.36 ha) linear area of potential habitat is likely to be affected by the proposal. Foraging opportunities will continue to exist and an abundance of similar and better quality foraging opportunities are found in adjacent habitat of Wianamatta Regional Park and wider locality. Owing to the small extent of potential habitat to be affected and the high mobility of these species, the proposal is not likely to significantly affect their long-term survival, although the loss of such habitat must be considered an incremental loss of local habitat.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Areas of declared critical habitat under the *Threatened Species Conservation Act* 1995, are now labelled as 'Areas of Outstanding Biodiversity Values' (AOBVs) in NSW with the commencement of the *Biodiversity Conservation Act*. The *Biodiversity Conservation Regulation* 2017 establishes the criteria for declaring AOBVs. The criteria have been designed to identify the most valuable sites for biodiversity conservation in NSW. The Proposal is would not impact any declared AOBVs nor are there any AOBVs identified for these species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan listing a number of recovery actions has been prepared for Large Forest Owls (Department of Environment and Conservation 2006), in which Powerful Owl is included. The overall objective of the NSW Large Forest Owl Recovery Plan is to

ensure that the large forest owl species persist in the wild in NSW in each region where they presently occur. No threat abatement plans have been prepared for these threatened species. The Office of Environment and Heritage has assigned these species as Landscape management species under the *Saving our Species* program with a number of recovery actions for the species (tables below). The proposal would not interfere significantly with any of the management actions within the Large Forest Owl Recovery Plan and is consistent with the recovery actions under *Saving our Species* program.

Table 3.7 Recovery actions for Powerful Owl

ACTION*	RELEVANCE TO PROPOSAL
Document and protect known nests. Ensure that no habitat degradation occurs within 100 m (e.g. hazard reduction burns or tree felling). Facilitate the location of new nest sites through observer training and encouragement.	Not relevant.
Negotiate with relevant landholders to enter into agreements, particularly in-perpetuity covenants or stewardship agreements, that promote the retention of large old trees, riparian habitat, owl roost sites and other high value habitat (as developed in the best practice guidelines).	Not relevant.
In regions where high priority powerful owl populations can be increased and stabilised, improve habitat quality and reconstruct connectivity. Focus initially on restoration of arboreal habitat that will foster populations of habitat-specific mammalian prey. Create wide corridors, especially in riparian habitat where prey are potentially more abundant due to better resources and soil fertility.	Not relevant.
At sites where tree hollows are few or declining within high priority powerful owl populations, trial the installation of nest boxes to increase mammalian prey densities. Expand the program if demonstrated to be effective for owls and use as a tool to educate the public about the impact of hollow loss.	Some Relevance. Removal of hollow-bearing trees would be replaced with nest boxes in undisturbed habitat and undertake habitat restoration to promote arboreal mammal utilisation.
Encourage development of citizen science programs in urban areas where an increase in community engagement is likely to create broader conservation awareness of powerful owls.	Not relevant.

WHETHER THE ACTION PROPOSED CONSTITUTES OR IS PART OF A KEY THREATENING PROCESS OR IS LIKELY TO RESULT IN THE OPERATION OF, OR INCREASE THE IMPACT OF, A KEY THREATENING PROCESS

With respect to large forest owls, the proposal is consistent with three key threatening processes under the BC Act:

- clearing of native vegetation
- loss of hollow-bearing trees.

The extent of native vegetation clearing and habitat removal associated with the proposal is considered small at approximately 2.36 ha. Although the proposal would represent the loss of potential habitat, this small area would only be a small component of locally occurring resources accessible to these species.

CONCLUSION

The Proposal footprint provides potential foraging habitat for the Powerful Owl. The proposal corridor largely provided moderate to poor habitat for these species and their prey, and as such may only be visited irregularly as part of their larger home range. An abundance of similar and potentially more significant habitat occurs in the wider locality that is suitable for habitation by these species. The proposal therefore, is considered to represent an incremental loss of available local habitat (2.36 ha), although it is not likely to have a significant impact upon these species.

3.6 CUMBERLAND LAND SNAIL

3.6.1 STATUS

The Cumberland Land Snail (*Meridolum corneovirens)* is listed as an Endangered species under the BC Act.

3.6.2 HABITAT AND ECOLOGY

The Cumberland Land Snail (*Meridolum corneovirens*) is a terrestrial species of snail that is generally tan to dark orange in colour ranging from 15-30 mm in size (National Parks and Wildlife Service 2000). The species can be confused with introduced and other native snails, particularly the common garden snail (*Cantareus aspersus* *). Currently, there is little known about the biology, dispersal patterns and distance movement, however, current knowledge suggest the species is restricted to the Cumberland Plain and Castlereagh Woodlands of Western Sydney and also along the fringes of River Flat Forest, especially where it meets Cumberland Plain Woodland. Microhabitat features used by the species include the underparts of logs and other debris, leaf and bark accumulations around the bases of trees and sometimes under grass clumps. Loose soil is sometimes used by the species for burrowing. It is feeds on fungus and is generally active at night. Most of the known populations are small, isolated and vulnerable to impacts from clearing and habitat modification such as the removal of ground cover as this removes shelter, breeding habitat and sources of food (National Parks and Wildlife Service 2000). The species is known to be genetically structured over short distances. Population studies have shown that individuals from any one location (within a few metres of each other) are very likely to be genetically related and the genetic neighbourhood is limited to about 350 m (Clarke and Richardson 2002).

3.6.3 THREATS

There is generally a poor understanding of other threats to this species however the main recognised threat is clearing and degradation of Cumberland Plain Woodland remnants (Department of Environment Climate Change and Water 2010).

Key threatening processes that may affect this species include:

- clearing of native vegetation
- invasion of native plant communities by exotic perennial grasses
- invasion and establishment of exotic vines and scramblers
- high frequency fire.
- removal of dead wood and trees (Department of Environment Climate Change and Water 2010).

3.6.4 SPECIFIC IMPACTS

This species is able to occupy disturbed woodland vegetation if suitable cover (fallen timber, rubbish and leaf litter) is available. One individual was recorded in Cumberland Plain Woodland within the Proposal footprint. Remnant Cumberland Plain woodland where the understorey microhabitat was intact provides potential habitat for the species. Due to the number of records within the locality and a recorded individual within the Proposal footprint it is expected to occur within the mapped remnant vegetation areas. A total of 2.73 ha of habitat in the form of Cumberland Plain Woodland would be impacted by the proposal.

3.6.5 BC ACT SIGNIFICANCE ASSESSMENT

In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Suitable habitat for the Cumberland Land Snail was identified in the Proposal footprint, with approximately 2.73 ha likely to be affected by the proposal. The proposed habitat removal may affect the life cycle of individuals within the population through the removal of the vegetation constituting habitat for the species including sheltering sites which are likely to be used for breeding.

Given that the proposal is only likely to remove a small proportion of habitat for the species and that measures to minimise the loss of breeding habitat and minimise mortality will be implemented, the proposal is unlikely to affect the life cycle of the species to such an extent that the local population would to be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**

Not applicable.

- **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed**

The proposal is likely to affect approximately 2.73 ha of suitable habitat for this species.

- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action**

Habitat connectivity is not likely to be affected by the proposal. The majority of the Proposal footprint occurs on previously disturbed land within and immediately adjacent to the existing Links Road corridor and also urban development. Approximately 2.73 ha of suitable habitat is likely to be affected by the proposal with vegetation removal largely limited to a linear widening of the existing road corridor. As the subpopulations of this species in the study area are somewhat isolated from one another due to intervening areas of unsuitable habitat, such as roadways and areas with highly modified groundcover, the proposal is considered unlikely to substantially increase the present level of fragmentation of these subpopulations.

- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The extent of suitable habitat to be affected represents a relative small proportion of habitat available within the locality and surrounding landscape; particularly including the adjacent habitat along the South Creek and within Wianamatta Regional Park. The area of potential habitat to be removed is unlikely to be of critical importance to the long-term survival of the Cumberland Land Snail as it is small in relation to the extent of habitat available in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Areas of declared critical habitat under the *Threatened Species Conservation Act* 1995, are now labelled as 'Areas of Outstanding Biodiversity Values' (AOBVs) in NSW with the commencement of the *Biodiversity Conservation Act*. The *Biodiversity Conservation Regulation* 2017 establishes the criteria for declaring AOBVs. The criteria have been designed to identify the most valuable sites for biodiversity conservation in NSW. The Proposal would not impact any declared AOBVs nor are there any AOBVs identified for these species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan for the Cumberland Plan Land Snail has been produced under the BC Act. The recovery plan for the Cumberland Plain includes a total of four recovery objectives have been identified to assist in habitat recovery for the Cumberland Land Snail (Department of Environment Climate Change and Water 2010). Most of these strategies are not applicable to the proposal. The proposal is not likely to cause significant impacts with any management actions. The proposed weed management and relocation of woody debris are however considered to be consistent with the objectives of these recovery actions. In addition, measures to minimise habitat loss and mortality of individuals will be implemented around habitat to be cleared.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposal may result in or contribute to the following key threatening processes that may affect this species:

- clearing of native vegetation
- invasion of native plant communities by exotic perennial grasses

- invasion and establishment of exotic vines and scramblers
- removal of dead wood and trees (Department of Environment Climate Change and Water 2010).

The proposed vegetation clearing protocol, weed management and relocation of woody debris would minimise the impact of these processes.

Conclusion

Approximately 2.73 ha of known and potential habitat for the Cumberland Land Snail would be impacted. Measures to minimise habitat loss and mortality of individuals would be implemented and the area of habitat to be cleared. The impacts of the proposal are likely to constitute only a small proportion of the habitat and population of the species within the locality. The proposal is therefore unlikely to cause a significant impact on this species.

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APPENDIX F

SPECIES IDENTIFICATION VOUCHERS

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From: Andrew Orme <Andrew.Orme@rbgsyd.nsw.gov.au>
Sent: Wednesday, 31 October 2018 12:36 PM
To: Wyllie, Julia
Subject: BIS Enquiry #20780 - partial reply

Dear Julia,

Re: plant identification – partial reply for specimens from St Marys - collected 13th Sept 2018

- *Hibbertia pedunculata* - det. A.E. Orme, 31st Oct 18 – specimen retained
- *Grevillea juniperina* subsp. *juniperina* – conf. A.E. Orme, 15th Oct 18 – specimen retained
- *Dillwynia tenuifolia* – conf. A.E. Orme, 15th Oct 18 - not retained
- *Pultenaea parvifolia* – conf. A.E. Orme, 15th Oct 18 – specimen retained

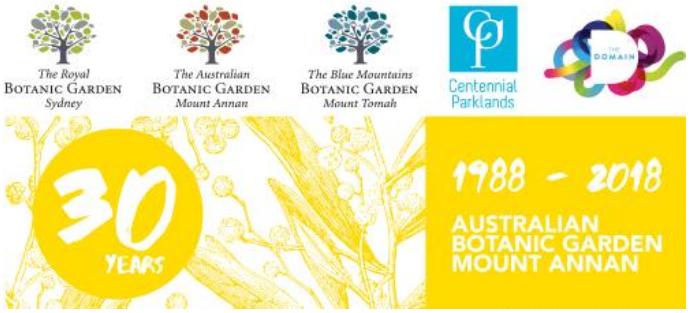
I hope to have the Acacia and Diuris specimens completed soon.

Yours sincerely

Andrew

Andrew Orme
Identifications Technical Officer – Botanical Information
National Herbarium of New South Wales

Botanic Gardens & Centennial Parklands
T (02) 9231 8154 | **M** 0410 025 101
E andrew.orme@environment.nsw.gov.au
Mrs Macquarie Road, Sydney NSW 2000



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APPENDIX C

TRAFFIC IMPACT STUDY

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LENDLEASE COMMUNITIES

Links Road Extension

Traffic Impact Study

NOVEMBER 2018

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WSP
Level 27, 680 George Street
Sydney NSW 2000
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Fax: +61 2 9272 5101
wsp.com

REV	DATE	DETAILS
	9/11/2018	Draft report
A	19/11/2018	Final report

	NAME	DATE	SIGNATURE
Prepared by:	Qian Liu Christopher Wong	19/11/2018	Q. Li
Reviewed by:	Ryan Miller	19/11/2018	R. Miller
Approved by:	Ryan Miller	19/11/2018	R. Miller

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ABBREVIATIONS

LGA	Local Government Area
SREP 30	Sydney Regional Environmental Plan No. 30
TIA	Traffic Impact Study
SEE	Statement of Environmental Effects
DA	Development Application
SIDRA	Signalised (and unsignalised) Intersection Design and Research Aid
AIMSUN	Advanced Interactive Microscopic Simulator for Urban and Non-Urban Network
LoS	Level of Service
DoS	Degree of Saturation
Roads and Maritime	Roads and Maritime Services
DP&E	Department of Planning & Environment
TfNSW	Transport for NSW
PCC	Penrith City Council
BCC	Blacktown City Council
SES	State Emergency Service
PCU	Passenger Car Unit

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1 PROJECT BACKGROUND

1.1 OVERVIEW

Lendlease Communities are proposing to construct an extension of Links Road to connect with Christie Street within St Marys, NSW (the Proposal). Links Road is a local road that currently serves the existing Dunheved Industrial Area and is within the Penrith Local Government Area (LGA). The aim of this road extension is to provide additional access to the St Marys Development Site from the south via Christie Street.

1.2 SITE LOCATION

The Proposal is located within the suburb of St Marys, which is approximately five kilometres north-east of Penrith and 45 kilometres west of Sydney CBD. The Proposal would extend from the frontage of the South Dunheved Precinct (within the St Marys Development Site), along the existing north-south section of Links Road (adjacent to the Dunheved Golf Course) connecting to Christie Street near the Lee Holm Road intersection. It would provide an additional access point to the St Marys Development Site via Christie Street (refer to Figure 1.1).



Figure 1.1 Location of the proposal in relation to the St Marys Development site

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The St Marys Development Site covers an area of approximately 1,545 hectares and comprises five precincts including (refer to Figure 1.2):

- Jordan Springs (formerly known as Western Precinct)
- Jordan Springs East (formally known as Central Precinct)
- Ropes Crossing (formerly known as Eastern Precinct and Ropes Creek Precinct)
- North Dunheved
- South Dunheved.

The Precincts are development areas identified under the Sydney Regional Environmental Plan No. 30 – St Marys (SREP 30) that are being delivered by Lendlease.



Figure 1.2 St Marys Development Site precinct locations

1.3 DESCRIPTION OF PROPOSAL

The key components of the Proposal are:

- Upgrading the existing Links Road from Dunheved Precinct to Dunheved Golf Club
- Extending Links Road to Christie Street
- Construction of a new four-way signalised intersection at Christie Street and Lee Holm Road
- Utility works and drainage upgrades
- Provision of supporting roadside infrastructure, including street lighting and signage.

It is anticipated that the construction of the Proposal would begin in 2019 and would take approximately ten months to complete. This start date and duration would be subject to approvals, land acquisition, contingency and coordinating with other construction activities in St Marys.

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1.4 PURPOSE OF THE REPORT

This Traffic Impact Study (TIA) forms part of the Statement of Environmental Effects (SEE) to support the Proposal's Development Application (DA). This TIA has been prepared to outline the likely impacts of the Proposal (both during construction and post construction stages) and proposes measures that would mitigate these impacts. Key aspects discussed in this TIA include:

- A description of traffic performance and capacity for the roads and intersections.
- A description of existing conditions, including site location, road network, intersection and mid-block performance, public transport, cycle and pedestrian facilities.
- A discussion of traffic and transport impacts on the intersection and mid-block performance, the surrounding local road network, access, public transport and pedestrians and cyclists during construction and operation of the proposal.
- A discussion on proposed mitigations to manage and mitigate the potential traffic and transport impacts.

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2 METHODOLOGY

This section outlines the relevant traffic modelling and assessment methodology.

In 2017, WSP undertook a St Marys Development Site Regional Traffic Modelling Study (hereafter referred as St Marys Modelling Study). The scope of works included the development of an AIMSUN mesoscopic model and associated SIDRA intersection modelling, to assess the impacts associated with the St Marys Development Site on the road network external to the St Marys Development Site. Council and Lendlease has agreed that the delivery of the Links Road upgrade/extension represented a preferred outcome to both parties following the St Marys Modelling Study.

This TIA study has been developed based on the outcomes from the above modelling study and utilises the projected future network traffic volumes from the AIMSUN modelling undertaken. This TIA study primarily assessed the intersection of Christie Street and Lee Holm Road as the key intersection using Signalised (and unsignalised) Intersection Design and Research Aid (SIDRA) modelling. SIDRA modelling is an advanced lane-based micro-analytical tool which is widely accepted by the industry for design and evaluation of individual intersections and network of intersections.

2.1 TRAFFIC PEAK HOURS

The analysed peak hours are the weekday AM peak between 8.00 am and 9.00 am, and the weekday PM peak between 5.00 pm and 6.00 pm. These peak hours were derived from the St Marys Modelling Study which represent the worst traffic conditions on the road network.

2.2 TRAFFIC SURVEYS

Intersection traffic turning counts at the intersection of Christie Street and Lee Holm Road were undertaken on Thursday 8 September 2016 by TTM as part of the St Marys Modelling Study. An automatic fully classified mid-block traffic count was also undertaken on Links Road, west of Ropes Crossing Boulevard, between 6 and 12 September 2016.

2.3 INTERSECTION PERFORMANCE

Level of Service (LoS) and Degree of Saturation (DoS) are both basic performance parameters used to describe the operation of an intersection. The LoS range from A to F based on the operational performance primarily determined by the average traffic delay at the signalised intersections and roundabouts, as indicated in Table 2.1.

Table 2.1 Level of service criteria for signalised intersections

Level of Service	Average delay (seconds per vehicle)	Traffic signals
A	Less than 14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity and incident would cause excessive delays
F	Greater than 71	Unsatisfactory with excessive queuing

Source: Roads and Traffic Authority *2002 Guide to Traffic Generating Developments*

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2.4 MID-BLOCK CAPACITY

Extracted from Austroads *Guide to Traffic Management Part 3*, Table 2.2 sets out typical mid-block capacities for various types of urban roads with interrupted flow, with unflared major intersections and with interruptions from cross and turning traffic at minor intersections. Mid-block capacity represents the maximum volume of vehicles that traverse a uniform segment of roadway during a given time period. A comparison between the actual mid-block flow and the theoretical mid-block capacity reflects the mobility and quality of travel of a section of road.

Table 2.2 Typical mid-block capacities for urban roads with interrupted flow

Type of lane	One-way mid-block capacity (pc/h)
Median or inner lane	
Divided road	1000
Undivided road	900
Middle lane (of a three-lane carriageway)	
Divided road	900
Undivided road	1000
Kerb lane	
Adjacent to parking lane	900
Occasional parked vehicles	600
Clearway conditions	900

Sources: Austroads *Guide to Traffic Management Part 3: Traffic Studies and Analysis*

2.5 ASSESSMENT SCENARIOS

This TIA includes several future year testing scenarios which analyse the proposal's impact under various conditions. The analysed scenarios are summarised in Table 2.3. Future year intersection assessment includes both base intersection layout (without Links Road extension) and future intersection layout (with Links Road intersection).

Table 2.3 Future year traffic modelling scenarios

Year	Without rezoning	With rezoning
2021 – Full completion of St Marys Development Site and Links Road extension	Without Links Road extension With Links Road extension	Without Links Road extension with Links Road extension
2026 – 5 years' post-full development of St Marys Development Site	Without Links Road extension With Links Road extension	Without Links Road extension With Links Road extension
2031 – 10 years' post-full development of St Marys Development Site	Without Links Road extension With Links Road extension	Without Links Road extension With Links Road extension

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For all future year scenarios, this TIA assessment took into consideration all land uses associated within the St Marys Development Site, including details of the land uses under the current zoning across all precincts within the St Marys Development Site, and the anticipated land uses associated with the Jordan Springs East rezoning. The "with rezoning" scenario relates to the provision of 500 additional residential dwellings in place of the employment land within Jordan Springs East, when compared to the "without rezoning" scenario.

Three analysed future years assessed were 2021 (full completion of St Marys development), 2026 (five years after the completion of St Marys development) and 2031 (10 years after the completion of the St Marys development). These analysed years align with the years in the St Marys Modelling Study.

Road network assumptions analysed in this TIA are consistent with the St Marys Modelling Study which were approved and endorsed by the Traffic Steering Committee including representatives of Roads and Maritime Services (Roads and Maritime), the Department of Planning & Environment (DP&E), Transport for NSW (TfNSW), Penrith City Council (PCC) and Blacktown City Council (BCC).

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3 EXISTING CONDITIONS

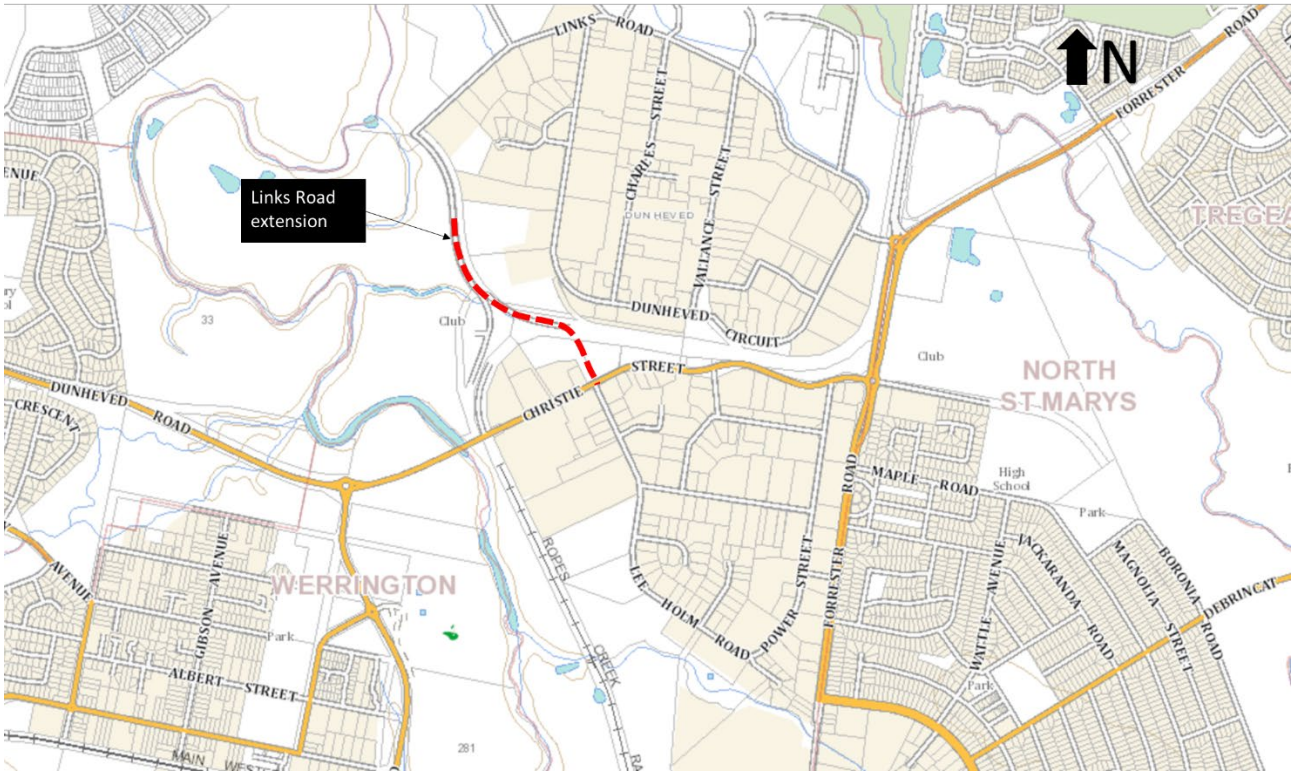
3.1 ROAD NETWORK

The existing local road network surrounding the Proposal (refer Figure 3.1) includes:

- Links Road and Dunheved Circuit, which forms a ring road that provides local access to the industrial land uses north of Christie Street. Links Road connects Ropes Crossing Boulevard to the east and terminates at the Dunheved Golf Club to the west. The posted speed limit is 60 km/h. Due to limited access, the section of Links Road adjacent to the Dunheved Golf Club currently contains a narrow carriageway and no kerb and gutter. Links Road is a local road.
- Lee Holm Road, which is a north-south local road which connects Christie Street to the north. This road provides access to the industrial land uses such as Dunheved Business Park, located south of Christie Street. The posted speed limit is 60 km/h. Lee Holm Road is a local road.
- The Dunheved Road/Christie Street Corridor, which is an east-west sub-arterial road that runs parallel to the Great Western Highway, with a speed limit of 60 km/h. It is a one-lane carriageway in each direction and provides right- turning lanes at several priority-controlled T-junctions. The Dunheved Road/Christie Street Corridor is classified as a regional road.
- Forrester Road, which is predominantly a two-lane dual carriageway. Forrester Road runs north–south connecting Palmyra Avenue and the Great Western Highway. Servicing vehicles within St Marys and Ropes Crossing, Forrester Road is another major sub-arterial corridor. Forrester Road operates between 60 and 70 km/h, with several signalised and priority-controlled intersections accessing local roads. The Forester Road Corridor is classified as regional road.
- Werrington Road, which is a north-south one-lane sub-arterial road, providing a vital connection between the Great Western Highway and Dunheved Road and Christie Street. Werrington Road is a regional road.

The key intersection at Christie Street/Lee Holm Road for this TIA study is a priority-controlled T-intersection. Traffic priority is currently given the Christie Street approach, which runs in an east-west direction.

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Source: *NSW Government Six Maps*

Figure 3.1 Existing road network adjacent the Proposal

3.2 ON-STREET PARKING

On-street parking is generally permitted in the kerbside parking lanes on both sides of Christie Street except for the kerb sections at driveways or NO STOPPING/NO PARKING zones. Christie Street between the bridge east of the Werrington Road roundabout and Lee Holm Road is estimated to be able to accommodate 350-metre kerbside parking on both road sides equating approximately 60 general parking spaces. East of Lee Holm Road, the kerbside parking lanes of approximately 850 metres in length on both sides of Christie Street extend into Forrester Road intersection which are estimated to facilitate 140 general parking spaces. Due the narrow carriageway of Lee Holm Road, on-street parking is less utilised although parking restrictions are not currently implemented. On-street parking is utilised in Links Road where road width permits between the intersection with Dunheved Circuit and the 90-degree road bend at the Sydney Water pump station. Overall there is ample on-street parking supply in the immediate surround road network.

3.3 EXISTING INTERSECTION PERFORMANCE AT CHRISTIE STREET/LEE HOLM ROAD

A two per cent annual traffic growth rate was applied to the 2016 traffic count data to project traffic growth to reflect current traffic conditions (2018). This growth rate is considered as appropriate and is based upon future year traffic demands as per the Roads and Maritime Strategic EMME Model. Heavy vehicles make up approximately 8.0 per cent of the overall intersection vehicle demand flow during the AM peak hour and 3.2 per cent during the PM peak hour. The resulting traffic volumes at the intersection of Christie Street and Lee Holm Road are summarised in Table 3.1 below.

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Table 3.1 Christie Street/Lee Holm Road – estimated intersection volumes in 2018

Weekday peak	Intersection traffic volumes (total vehicles per hour)					
	Lee Holm Road (south)		Christie Street (east)		Christie Street (west)	
	L	R	L	T	T	R
AM peak	41	13	46	710	850	68
PM peak	91	8	7	1210	708	9

Table 3.2 below summarises the estimated mid-block traffic volumes in 2018.

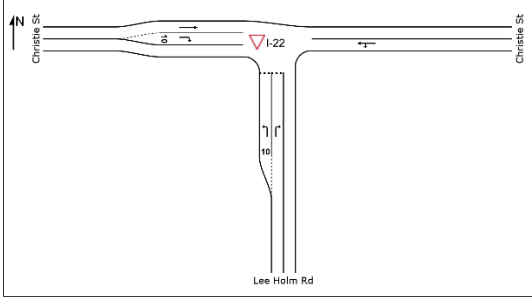
Table 3.2 Christie Street and Lee Holm Road – estimated mid-block volumes in 2018

Road (section)	Mid-block traffic volumes (total vehicles per hour)			
	Weekday AM peak		Weekday PM peak	
	EB/NB	SB/WB	EB/NB	SB/WB
Christie Street (east)	863	756	716	1217
Christie Street (west)	918	751	717	1301
Lee Holm Road (south)	54	114	99	16

It is noted that the traffic volumes on Christie Street were found to exceed the typical theoretical one-lane capacity of 900 passenger car unit (pcu)/hour based upon mid-block capacity guidelines. A volume of 918 vehicles (west of Lee Holm Road) was identified in the eastbound direction during the weekday AM peak period. Volumes of 1217 vehicles (east of Lee Holm Road) and 1301 (west of Lee Holm Road) were expected in the westbound direction during the weekday PM peak period. This indicates that Christie Street is carrying volumes over its theoretical capacity, particularly during weekday PM peak hours. Based on the site observation and traffic survey, Christie Street appears to operate satisfactorily under existing typical conditions.

The resulting trips as shown in Table 3.1 were modelled in SIDRA using the existing layout of the intersection of Christie Street and Lee Holm Road. The performance is summarised in Table 3.3 below.

Table 3.3 The Christie Street/Lee Holm Road performance summary in 2018

Christie Street/Lee Holm Road intersection	Weekday AM peak	Weekday PM peak
	Total Vehicle: 1814 veh/h Degree of Saturation: 0.540 Average Delay: >200 s (south approach right turn) Level of Service: F 95% Back of Queue: 14.2 metres (south approach)	Total Vehicle: 2140 veh/h Degree of Saturation: 0.699 Average Delay: >300 s (south approach right turn) Level of Service: F 95% Back of Queue: 14.3 metres (south approach)

The intersection currently contains one travel lane per each direction in Christie Street as well as Lee Holm Road. This intersection was however set up in SIDRA to incorporate a short right-turn lane on the west approach and a short left-turn on the south approach to reflect the actual driving behaviour. As shown in the performance summary Table 3.3, long delays associated with the south approach right-turn movement resulted in an unsatisfactory Level of Service "F" in both weekday AM and PM peak periods. Detailed SIDRA results are presented in Appendix A.

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Table 3.4 summarises estimated mid-block traffic volumes on Links Road, west of Ropes Crossing Boulevard in 2018, based on the survey data from 2016. This does not include current traffic due to new development on Links Road, rather factors up the 2016 traffic volumes. The traffic volumes of Links Road are low and within the typical one-lane capacity of 900 passenger car unit (pcu)/hour. The section adjacent to the Dunheved Golf Club is anticipated to contain minimal traffic flow, given it is currently a no-through road.

Table 3.4 Links Road, west of Ropes Crossing Boulevard – estimated mid-block volumes in 2018 (vehicles)

Road	Mid-block traffic volumes (total vehicles)			
	Weekday AM peak		Weekday PM peak	
	EB	WB	EB	WB
Links Road	210	525	664	261

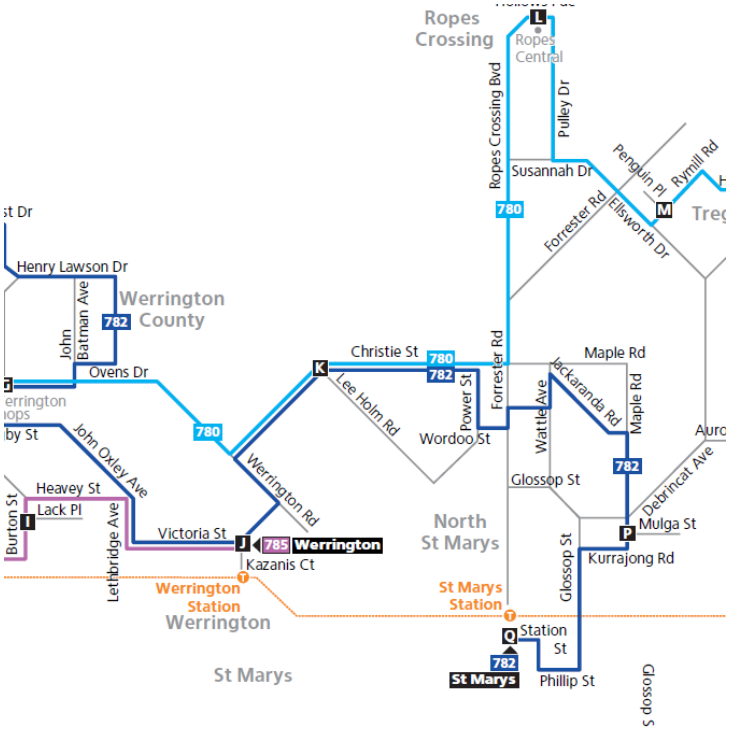
3.4 PUBLIC TRANSPORT

3.4.1 RAIL

Werrington Station and St Marys Station are the closest train stations, which are located approximately two kilometres from the location of the Proposal. Both train stations are serviced by the T1 Western Line (Emu Plains to the City).

3.4.2 BUS

Route 780 currently provides services between Mount Druitt to Penrith via Ropes Crossing. Route 782 provides services between St Marys to Penrith via Werrington. Both routes travel along Christie Street between Power Street and Werrington Road, and travel through the intersection of Christie Street and Lee Holm Road. There is an existing bus stop located on the northern side of Christie Street, directly opposite to Lee Holm Road, and on the southern side, west of Lee Holm Road.



Source: Busways Western Sydney network map, Transport for NSW, reviewed on 10 October 2018

Figure 3.2 Existing bus network adjacent the Proposal

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3.5 CYCLE NETWORK

No designated cycling facilities are provided on Christie Street, Lee Holm Road or Links Road within the vicinity of the Proposal. The development within St Marys Development Site is comparatively friendly for cycling compared with older suburbs, with slower speed roads, tighter intersection radii and shared paths either planned or already constructed.

3.6 PEDESTRIAN FACILITIES

Limited pedestrian footpaths or pedestrian crossings are provided within the vicinity of the proposal site. Footpaths currently exist on the southern side of Christie Street for its entire length. There are no footpaths on Lee Holm Road or Links Road.

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4 OPERATIONAL IMPACTS

4.1 FUTURE INTERSECTION PERFORMANCE

SIDRA modelling analysis of the Christie Street and Lee Holm Road intersection with and without the proposal, was undertaken to determine the potential impact of the proposal on the intersection performance. The assessment involved the projected future demand volumes from the AIMSUN model from the St Marys Modelling Study. The projected intersection volumes are presented in Appendix B.

4.1.1 EXISTING LAYOUT INTERSECTION PERFORMANCE (WITHOUT LINKS ROAD EXTENSION)

Table 4.1 below summarise the future intersection performance utilising the existing intersection layout without Links Road extension. Detailed SIDRA outputs are presented in Appendix C. It is evident that the priority-controlled intersection layout at Christie Street and Lee Holm Road will continue to operate poorly, with unsatisfactory LoS "F" predicted under all future year scenarios. The right-turn movement out of Lee Holm Drive will experience extensive delays. The intersection will be operating over capacity from the 2021 weekday PM peak hours when excessive queues are forecast to occur.

Table 4.1 Christie Street/Lee Holm Road intersection performance summary – future year scenarios

Year	Scenarios	Weekday AM peak				Weekday PM peak			
		DoS[1]	Delay[2] (sec)	LoS[3]	Queue[4] (m)	DoS	Delay (sec)	LoS	Queue (m)
2021	without rezoning	0.48	112	F	7 (W)	0.84	>200	F	35 (S)
	with rezoning	0.45	86	F	7 (W)	0.86	>200	F	38 (S)
2026	without rezoning	0.85	>200	F	61 (W)	0.97	>200	F	59 (S)
	with rezoning	0.74	>200	F	34 (W)	>1	>200	F	254 (S)
2031	without rezoning	>1	>200	F	91 (W)	>1	>200	F	>500 (W)
	with rezoning	>1	>200	F	81 (W)	>1	>200	F	>500 (W)

(1) DoS: Degree of Saturation

(2) Delay: Average delay (seconds)

(3) LoS: Level of Service

(4) Queue: 95th percentile queue (metres) and approach

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4.1.2 PROPOSED LAYOUT INTERSECTION PERFORMANCE WITH LINKS ROAD EXTENSION

The proposed four-way intersection of Christie Street/Lee Holm Road/Links Road layout in SIDRA analysis, as indicated in Figure 4.2 below, was developed based on the concept design prepared by WSP (refer to Figure 4.1). The proposed four-way intersection is controlled by a new traffic signal, with two lanes in each direction on Christie Street when approaching the intersection. With the exception for the west approach, dedicated right turn lanes will be provided on the other three approaches. A left-turn slip lane will be provided on the west approach. Pedestrian crossings will be included on all legs.

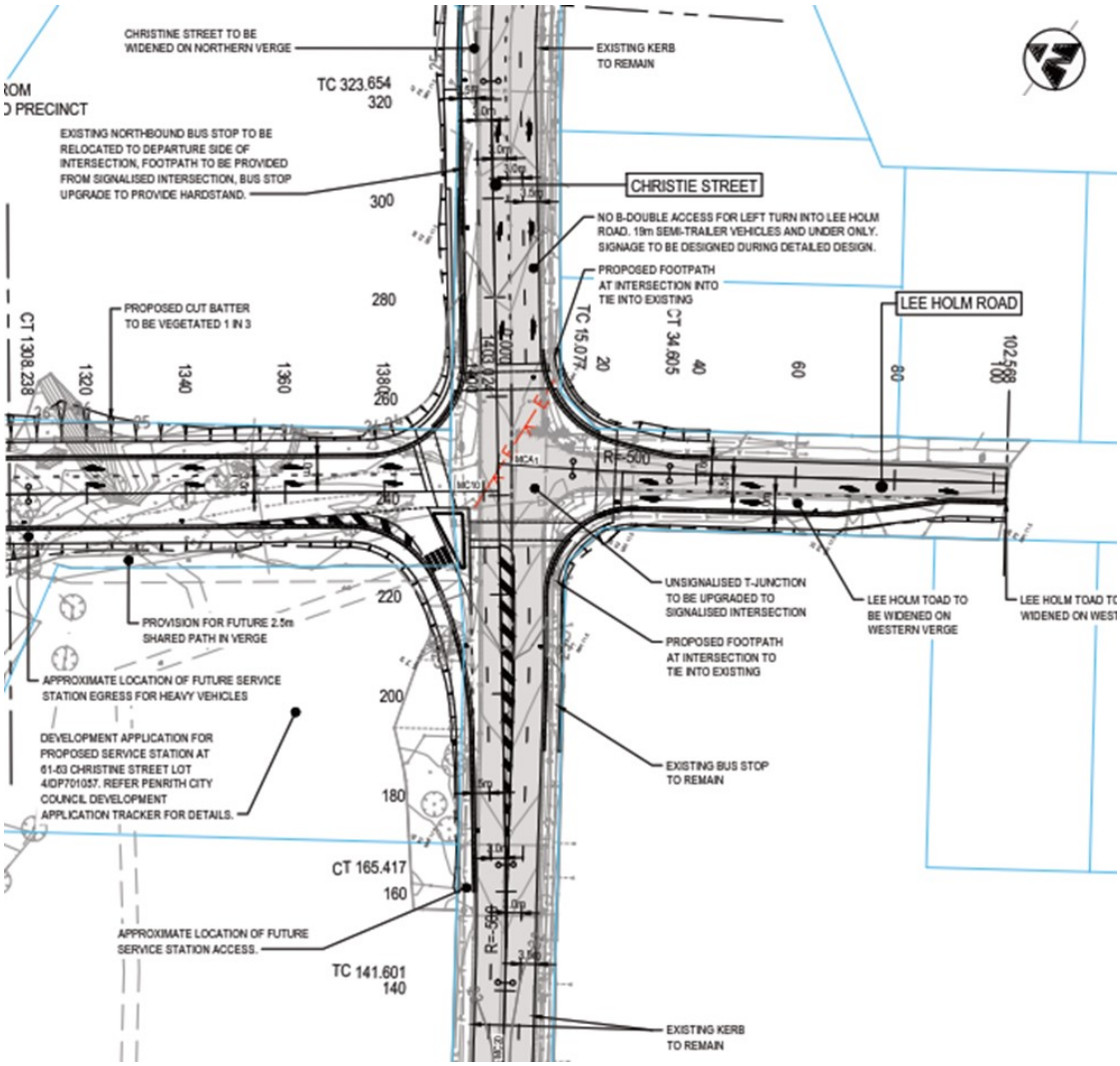


Figure 4.1 Concept design of the intersection of Christie Street/Links Road/Lee Hold Road (WSP)

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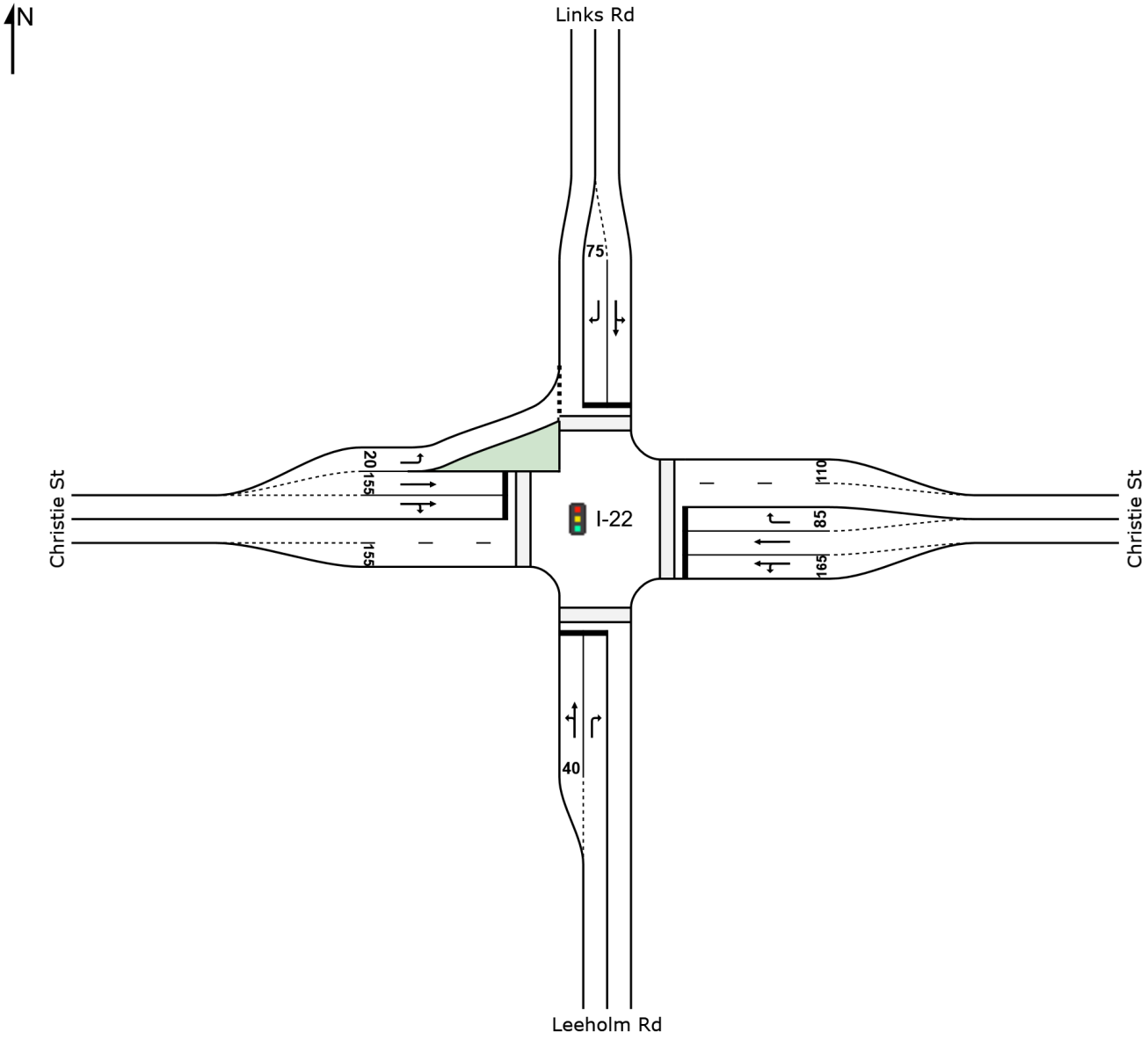


Figure 4.2 Proposed intersection layout at Christie Street/Lee Holm Road/Links Road

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Table 4.2 below summarises the future year intersection performance under the proposed layout with the Links Road extension. Detailed SIDRA outputs are presented in Appendix D.

Table 4.2 Christie Street/Lee Holm Road/Links Road intersection performance summary – future year scenarios (proposed intersection layout)

Year	Scenarios	Weekday AM peak				Weekday PM peak			
		DoS[1]	Delay[2] (sec)	LoS[3]	Queue[4] (m)	DoS	Delay (sec)	LoS	Queue (m)
2021	without rezoning	0.54	10	A	73 (W)	0.53	12	B	99 (E)
	with rezoning	0.59	13	B	92 (W)	0.53	12	B	99 (E)
2026	without rezoning	0.65	13	B	103 (W)	0.64	17	B	128 (E)
	with rezoning	0.64	12	B	95 (W)	0.60	15	B	117 (E)
2031	without rezoning	0.89	20	C	234 (W)	0.73	14	B	130 (E)
	with rezoning	0.91	22	C	240 (W)	0.75	14	B	123 (E)

(1) DoS: Degree of Saturation

(2) Delay: Average delay (seconds)

(3) LoS: Level of Service

(4) Queue: 95th percentile queue (metres) and approach

As shown in Table 4.3, with the Links Road extension and the intersection upgrade, the intersection will operate satisfactorily at the LoS "C" or better under all future year scenarios. The intersection will sustain until 2031 with DoS only marginally exceeding 0.9 during the 2031 weekday AM peak with rezoning.

Overall, the Proposal is expected to substantially improve the intersection performance at the intersection of Christie Street/Lee Holm Road/Links Road from LoS F to LoS C or better in future years. The estimated queue length would be reduced by the implementation of the proposal for the worse performing movement under the priority-controlled intersection. This modelling results also revealed lower intersection degree of saturation as a result of the proposal which indicates that the updated intersection would provide spare capacity.

4.2 FUTURE ROAD PERFORMANCE

Table 4.3 below summarises the estimated mid-block traffic volumes in 2021, 2026 and 2031 without the Links Road extension. It can be concluded that without the proposed Links Road extension, Christie Street will reach its theoretical mid-block capacity in all future year scenarios. Higher traffic volumes will travel along Christie Street in the eastbound direction than westbound during the weekday AM peak period. During the PM peak period, significantly more traffic will travel in the westbound direction than the eastbound.

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Table 4.3 Christie Street and Lee Holm Road – estimated mid-block traffic volumes in 2021, 2026 and 2031 without Links Road extension (vehicles)

Year	Road (section)	Mid-block traffic volumes (total vehicles per hour)							
		Weekday AM peak				Weekday PM peak			
		Without rezoning		With rezoning		Without rezoning		With rezoning	
		EB/NB	SB/WB	EB/NB	SB/WB	EB/NB	SB/WB	EB/NB	SB/WB
2021	Christie Street (east)	918	770	858	772	746	1254	846	1248
	Christie Street (west)	1042	818	982	830	796	1366	899	1359
	Lee Holm Road (south)	56	132	67	133	117	55	111	53
2026	Christie Street (east)	1191	905	1100	866	892	1332	884	1354
	Christie Street (west)	1341	968	1240	942	939	1435	954	1462
	Lee Holm Road (south)	66	153	82	146	109	53	112	74
2031	Christie Street (east)	1172	910	1074	944	861	1386	908	1362
	Christie Street (west)	1351	1005	1238	1053	965	1514	1007	1502
	Lee Holm Road (south)	109	193	120	175	172	148	177	136

Table 4.4 below summarises the estimated mid-block traffic volume in 2021, 2026 and 2031.

Table 4.4 Christie Street, Lee Holm Road and Links Road – estimated mid-block volumes in 2021, 2026 and 2031

Year	Road (section)	Mid-block traffic volumes (vehicles per hour)							
		Weekday AM peak				Weekday PM peak			
		Without rezoning		With rezoning		Without rezoning		With rezoning	
		EB/NB	SB/WB	EB/NB	SB/WB	EB/NB	SB/WB	EB/NB	SB/WB
2021	Christie Street (east)	778	700	818	665	676	1144	674	1149
	Christie Street (west)	1004	846	988	898	865	1392	865	1385
	Lee Holm Road (south)	46	152	65	145	143	35	127	34
	Links Road (north)	145	171	107	250	180	131	177	129
2026	Christie Street (east)	988	770	897	823	834	1172	721	1177
	Christie Street (west)	1084	961	1015	1034	951	1510	833	1461
	Lee Holm Road (south)	68	163	71	155	175	33	134	51
	Links Road (north)	101	291	58	235	167	246	141	230
2031	Christie Street (east)	1093	778	1016	867	773	1364	796	1359
	Christie Street (west)	1483	1092	1414	1217	1174	1621	1278	1615
	Lee Holm Road (south)	90	148	86	161	120	79	130	79
	Links Road (north)	417	399	380	407	397	212	465	188

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The traffic volumes of Links Road, north of the four-way intersection will be within the typical one-lane capacity of 900 passenger car unit (pcu)/hour, where the highest volume of 465 (pcu)/hour will be expected in the northbound direction during the PM peak period with rezoning. This indicates that this section of Links Road has spare capacity to accommodate the projected future traffic growth and development traffic generation. The proposed road upgrade without significant road widening along this section of Links Road is therefore considered adequate. Christie Street is estimated to become more trafficked in future years. Traffic volumes on Lee Holm Road will remain low.

With the Links Road extension and the additional lanes on Christie Street as part of the intersection upgrade at the intersection of Christie Street/Lee Holm Road/Links Road, the projected volumes on Christie Street will be well under its theoretical capacity in future years and thus unlikely result in congestions.

In the St Marys Modelling Study, the Links Road extension was assessed to redirect approximately 300 vehicles per hour (vph) in 2021 and 600 vph in 2031 from the Forrester Road/Ropes Crossing Boulevard and Forrester Road/Christie Street intersections to the Links Road Extension/Christie Street/Lee Holm Road intersection. Overall, both AIMSUN and SIDRA modelling results indicate that the Links Road extension would not have a noticeable negative impact on the network performance in future years.

4.3 ACCESS IMPACT

Links Road in the proposal area currently has few property access points. The properties at 84, 92, 98 and 116 Links Road St Marys have existing driveways located on the southeast side of Links Road, near the future Dunheved Link Road end (refer to Figure 4.3). These driveways will not be altered by this Proposal. Dunheved Golf Club has its existing access to the car park at the southern end of the existing Links Road alignment. The Proposal will realign Links Road from 150 metres north of the Golf Club car park entrance. A new T-intersection with a median island on the approach to Links Road will be created at this road realignment point (refer to Figure 4.4). The design will allow full movements. Swept paths analysis has been undertaken which indicate that the design allows a 12.5-metre truck to perform the critical movement which is the left-turn in the southbound direction along Links Road. The access to the Golf Club therefore will not be negatively impacted.

The proposed Links Road extension is anticipated to improve the accessibility to the St Marys Development Site. The proposed Links Road extension will enhance the connection with the external network by providing an additional access point to the south. This proposed Links Road extension will substantially shorten some trip distances, particularly for future St Marys Development residents and Dunheved Golf Club visitors who are travelling to the south. The existing driveways off Links Road near the future Dunheved Link Road will remain unchanged and thus will not be adversely impacted by the Proposal. Full access to Dunheved Golf Club will be retained with no negative impact being anticipated.

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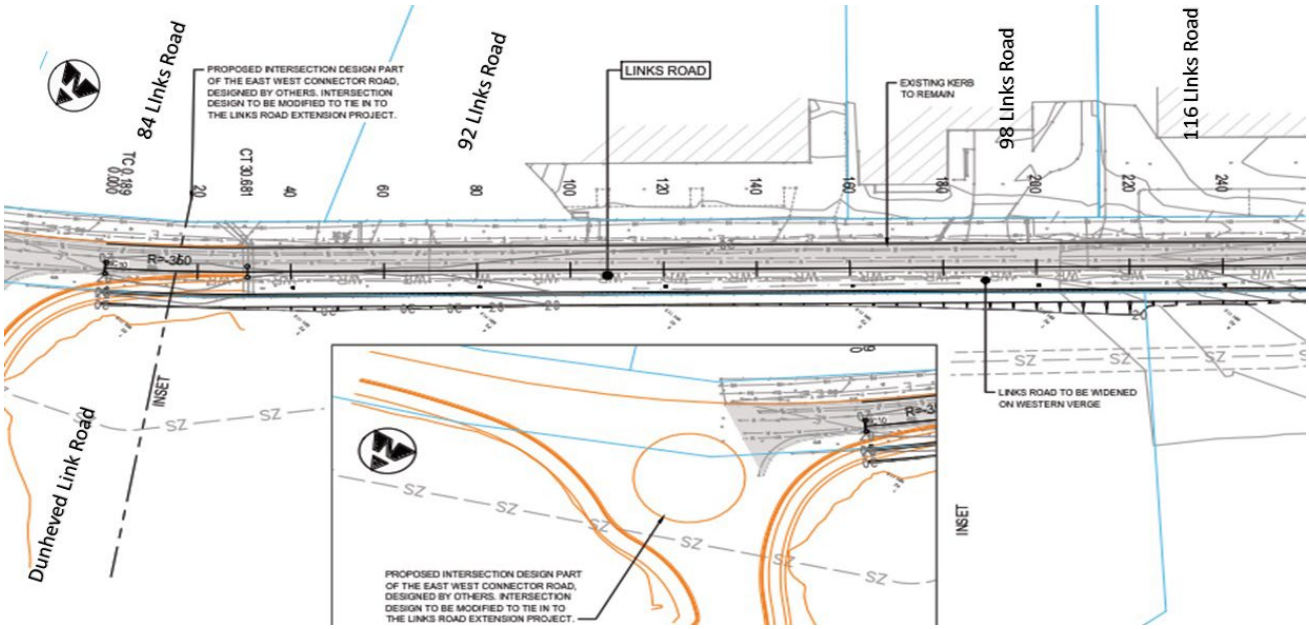


Figure 4.3 Concept design of Links Road extension near future Dunheved Link Road end (WSP)

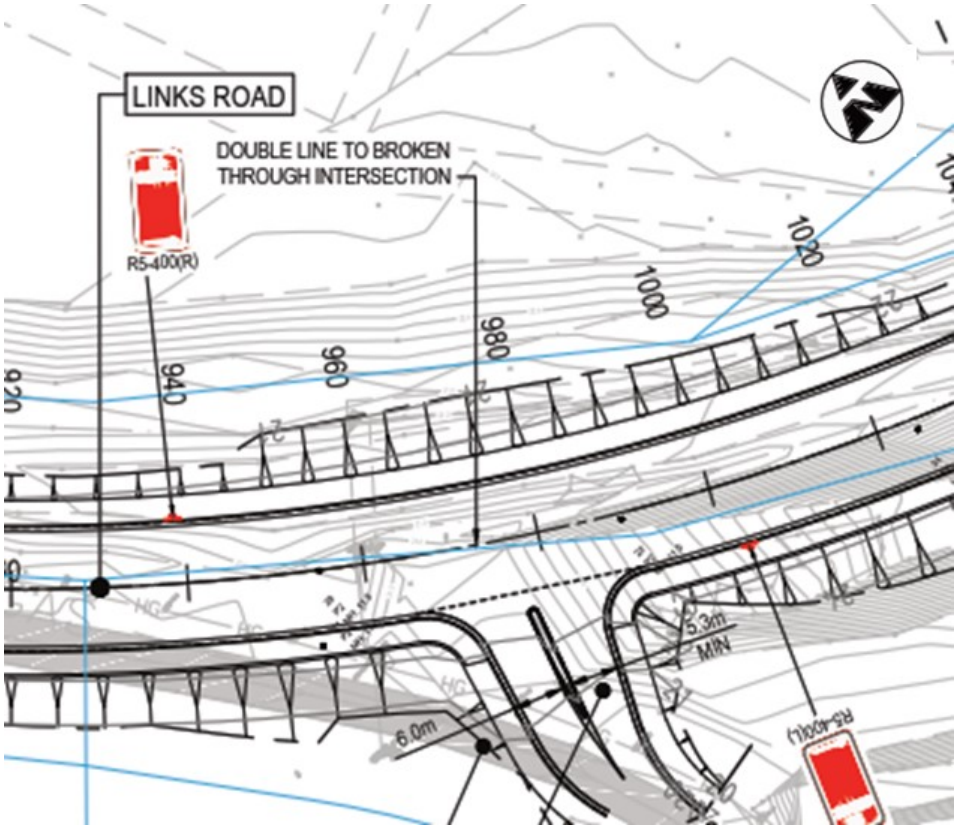


Figure 4.4 Concept design of Links Road extension near the access to Dunheved Golf Club (WSP)

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4.4 ON-STREET PARKING IMPACT

The implementation of the four-way signalised intersection at Christie Street/Lee Holm Road/Links Road would result in the removal of kerb side parking on both the northern and southern sides of Christie Street and the eastern and western sides of Lee Holm Road in order to comply with the statutory "NO STOPPING" requirement at signalised intersections. The number of on-street parking loss cannot be quantified at this stage as future signposting will be subject to Council and Roads and Maritime approval.

A three-metre-wide parking lane will be provided along the entire upgraded section of Links Road on both sides of the road which increases the on-street parking substantially and would likely compensate the loss of on-street parking due to the implementation of the new four-way signalised intersection. Overall, the Proposal will not negatively impact on-street parking on the adjacent road network.

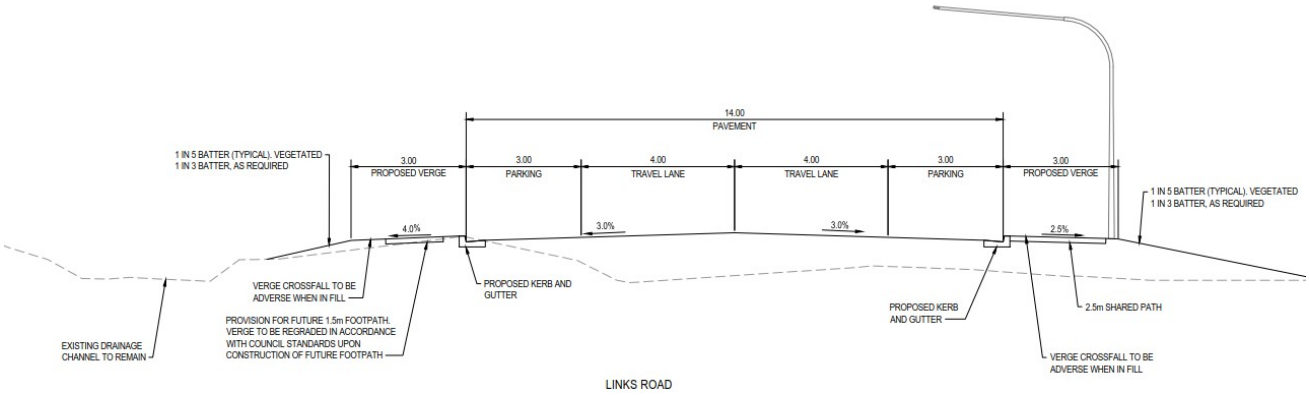


Figure 4.5 Concept design of Links Road extension - cross section at the upgraded section of Links Road (WSP)

4.5 PUBLIC TRANSPORT

The Proposal would not alter any existing public transport routes. The existing bus stops at the intersection of Christie Street and Lee Holm Road would be relocated as part of the Proposal. Future bus stop locations and routes are subject to consultation with the Council and the local bus operator Busways. The relocation of the bus stops may or may not increase walking distance for bus passenger. The accessibility to bus services would be improved by providing hardstand areas at the bus stops. This improvement will reduce safety hazards associated with slippery road surfaces in wet weather conditions.

4.6 ACTIVE TRANSPORT

The upgraded intersection at Christie Street/Lee Holm Road/Links Road would incorporate full pedestrian signals on all legs. The full pedestrian crossings on all legs at the upgraded intersection at Christie Street/Links Road/Lee Holm Road would greatly improve pedestrian and cyclist safety, particularly when crossing the busy Christie Street. Provision will be made to include footpaths immediately adjacent the Christie Street/Lee Holm Road/Links Road intersection where currently no footpath is available on the northern side of Christie Street. This will improve pedestrian access and moreover the access for people with disability.

The Proposal will also provide more direct north-south access for pedestrians and cyclists who need access to the St Marys Development Site. A 2.5-metre wide shared path has been proposed along the western side of Links Road between Christie Street intersection and the Dunheved Link Road intersection which will connect the shared path proposed or already implemented in the St Marys Development Site. Along the eastern side a 1.5-metre wide footpath has also been included.

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5 CONSTRUCTION IMPACTS

5.1 CONSTRUCTION METHODOLOGY

5.1.1 CONSTRUCTION ACTIVITIES

Table 5.1 summarises the anticipated construction activities and their sequencing for construction of the Proposal, as well as the plant and equipment that would be likely used to build the proposal. The plant and equipment needed to build the proposal would be typical of any major road construction site. The construction activities and plant and equipment list would be finalised by the contractor following detailed design.

Table 5.1 Indicative construction activities and equipment

Activity	Associated work	Indicative equipment	
Preparation and enabling	Obtain leases and licences Complete property acquisition Survey the construction site Relocate fencing Notify the community and stakeholders Establish the site compounds and access routes Fence the site boundaries and areas to be used for stockpile sites Protect sensitive areas as defined by the construction environmental management plan Install temporary erosion, sediment and water quality controls, including silt fences, and stormwater diversion drains Mark trees that would need to be removed or trimmed, and mark any “no-go” areas Install traffic management controls including any road closures and diversions Install noise mitigation measures and safeguards.	Light vehicles Trucks Excavators Generators Graders Site sheds	Back hoes Water carts Cranes Hand tools Low loaders
Utilities	Adjust/relocate utility infrastructure (water, gas, electricity and telecommunications) where required.	Light vehicles Trucks Hand tools Concrete saws	Generators Back hoes Water carts Elevated work platforms
Surface preparation	Remove and mulch vegetation in stages along the new road alignment Strip and stockpile topsoil in stages Prepare the surface using graders, dozers and other equipment.	Light vehicles Trucks Excavators Chainsaws Mulchers Rollers	Generators Back hoes Water carts Cranes Hand tools

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Activity	Associated work	Indicative equipment	
Earthworks	Excavate cuttings Create fill embankments Place select materials Construct roadside cuts and fill batters Prepare batter treatments Dispose of unsuitable and/or surplus material	Excavators Dump trucks Compactors Graders Front-end loaders Rollers	Water carts Profilers Bulldozers Vibratory rollers Rock breakers
Drainage	Install/extend culverts Install catch drains Install scour protection.	Excavators Concrete pumps Concrete trucks Graders	Trucks Bulldozers Cranes
Road surface	Gravel base/sub-base layers and asphaltic concrete paving Apply spray-seal.	Concrete trucks Concrete pumps Vibratory rollers Compactors Concrete saws Compressors Bitumen sprayers	Generators Milling machines Trucks Asphalt paving machines Asphalt trucks Rollers Batch plants
Tie in and road markings	Remove section of old road surface at each intersection and complete road widening and tie-in the new road to existing roads.	Light vehicles Trucks Hand tools	Generators Line marking machines
Finishing works	Conclude property access Complete tie-ins Install safety barriers Install kerbs, gutters and verges Rehabilitate disturbed areas and landscape Install line marking, signs and guide posts Decommission temporary facilities Clean-up and dispose of all surplus waste Installation of street lighting and signage.	Generators Trucks	Cranes Light vehicles

5.1.2 SITE COMPOUND

Two potential site compound locations are identified as show in Figure 5.1 below, including:

- The main site compound north of the project site, near Dunheved Link Road
- The satellite compound near the intersection with Christie Street in the abandoned railway line, used to place portaloos and/or small sheds.

Both site compound locations are easily accessible via Links Road.

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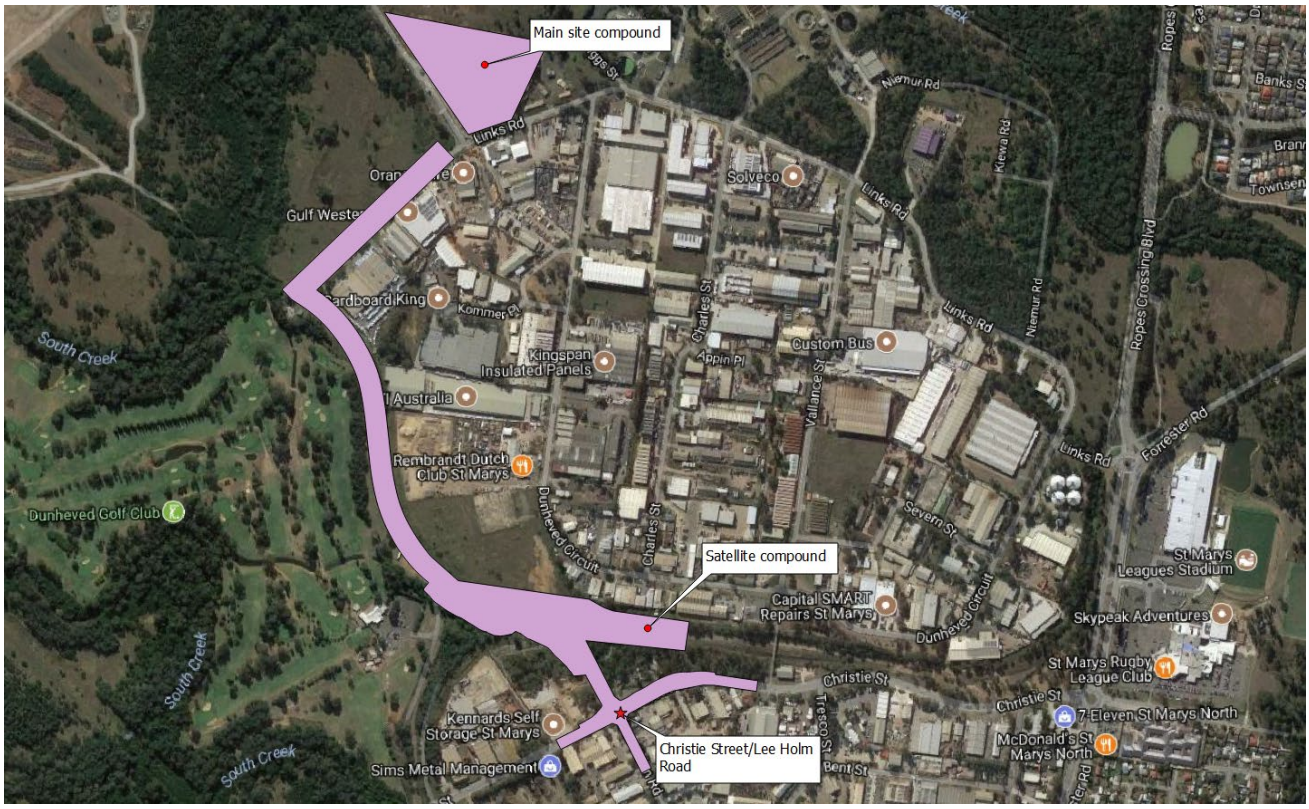


Figure 5.1 Site compound locations

5.1.3 WORK HOURS

It is anticipated that the construction of the Proposal would begin in 2019 and take approximately ten months. Most of the construction work would take place within the following standard working hours:

- Monday to Friday, 7.00 am to 6.00 pm
- Saturday, 8.00 am to 1.00 pm.

Some construction activities may be required outside of the standard working hours to minimise disruption to peak hour traffic, maintain property and pedestrian access during the day, and provide a safe working environment for construction workers.

These activities may include:

- Intersection upgrade works that are considered high-risk to be undertaken whilst maintaining the operation of all existing traffic lanes
- Pavement upgrade and re-surfacing works
- Traffic switch works to maintain property access during the day time
- Delivery of oversized plants or large prefabricated structures.

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5.1.4 CONSTRUCTION HAULAGE ROUTES

Access to the main site compound and satellite compound is likely to be via Links Road. A review of the Roads and Maritime vehicle restriction map revealed that several routes near the Proposal allow general heavy vehicle access, as indicated in Figure 5.2. The likely construction haulage routes comprising of these approved routes would be:

- From/to west: Links Road, Forrester Road, Christie Street and Dunheved Road (or Werrington Road and Great Western Highway)
- From/to east or north: Links Road, Forrester Road, Glossop Street and Great Western Highway
- From/to south: Links Road, Forrester Road, Glossop Street, Great Western Highway and Mamre Road.

The haulage routes may experience temporary increased vehicle movements due to the construction works.



Source: NSW combined higher mass limits and restricted access vehicle map, Roads and Maritime, valid as of 04/10/2018

Figure 5.2 Approved general heavy vehicle access (26 m B-double) routes on the road network in the study area

The estimated heavy vehicle movements associated with the construction activities during the weekday AM and PM peak periods will unlikely exceed ten. The light vehicle movements associated with the construction activities during weekday AM and PM peak periods are anticipated to be less than 50 based on previous experience with similar sized works. These additional traffic movements are considered generally comparable with the construction vehicles accessed the St Marys Development Site over the past three years and the ongoing construction activities by Sydney Water and others within the Dunheved Industrial Estate which has not resulted in unacceptable adverse impact on the surrounding road network. Given the low number of vehicle movements associated with the construction activities, the impact on the adjacent road network and property access would be negligible.

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5.2 ACCESS

The adverse impact on property access is minimal as property access is anticipated to be retained during construction periods by suitable traffic controls. The standard working hours will minimise negative impact during peak traffic operation periods as construction vehicle movements would generally occur outside peak hours.

Full access for emergency vehicles would be retained during the entire construction period. The proposed works would largely be on the western section of Links Road which contains minimal property access and thus this proposal is unlikely to have an impact on accesses for nearby properties. The access to the Dunheved Golf Club car park, located at the southern end of the existing Links Road, would be retained during construction with suitable traffic controls. implemented. Given the wide carriageway width, works on Christie Street and Lee Holm Road are likely to be accommodated with partial road/lane closures. The access to the affected properties will be fully retained under traffic controls throughout the construction period.

5.3 STAFF PARKING

Staff and visitor parking to the construction site would be provided within the main and satellite site compound areas (totalling approximately 1,200 m^2) and across work areas as necessary. It is estimated that the maximum staff numbers at one shift would be unlikely to exceed 50 with minimal visitors such as sub-contractors. The compound areas will be able to accommodate the staff and visitor parking which would ensure that there would be little to no parking overspill due to construction Adverse impact on on-street parking in the surrounding road network is therefore expected to be negligible.

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6 MITIGATION MEASURES

Whilst the operation and construction of the Proposal are not anticipated to generate unacceptable impacts on traffic and transport, the following migration measures have been developed to minimise any adverse impact:

- Detailed access arrangements to the site compounds such as temporary driveways will be developed at post-DA stage as part of the construction traffic management plan to ensure safety for vehicle access. It should aim to enable vehicles to enter and leave the sites in a forward direction, unless otherwise guided under qualified traffic controllers.
- Staff and visitors will be encouraged to car pool to reduce parking demand and thus minimise any parking overspill in any unlikely event.
- During construction, the NSW Police, Ambulance, NSW Fire and Emergency Services and State Emergency Service (SES) would be informed of any implementation of short/long term temporary partial/full road closure, related to this project, to minimise interruption to emergency vehicle access.
- Detailed traffic control plans would be developed as part of the construction traffic management plan at post-DA stage to retain property access and ensure safety, subject to Council approval.

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7 CONCLUSION

This report has been undertaken to consider the traffic impact of the proposed Links Road extension, taking into consideration the existing traffic volumes, future background traffic growth and trips generated from the St Marys Development Site. This included modelling the intersection of Christie Street/Lee Holm Road and assessing the future intersection performance under the proposed four-way signalised intersection layout. The trip redistribution of the Links Road extension was previously simulated as part of the St Marys Modelling Study using AIMSUN. This TIA has incorporated the projected volumes from the AIMSUN models to undertake SIDRA analysis at the key intersection. Assessments have been developed to investigate the mid-block capacity on affected roads, such as Christie Street, Lee Holm Road and Links Road.

The following concludes the key findings of the assessment:

- Under the existing conditions, long delays associated with the south approach right-turn movement resulted in an unsatisfactory Level of Service "F" at the intersection of Christie Street/Lee Holm Road during both AM and PM peak periods. Traffic volumes of Christie Street were found to exceed the typical one-lane capacity of 900 passenger car unit (pcu)/hour, where volumes of 1,217 (east of Lee Holm Road) and 1,301 (west of Lee Holm Road) were expected in the westbound direction during the PM peak period. The proposed Links Road extension and the four-way signalised intersection would improve the intersection performance to a satisfactory LoS "C" or better.
- The proposed Links Road extension will enhance the connection of the St Marys Development Site with the external network by providing an additional access point to the south. This proposed Links Road extension will substantially shorten some trip distances, particularly for future St Marys Development residents and Golf Club visitors who have their destinations to the south.
- The Proposal will not negatively impact on-street parking in the surrounding network.
- There will be no noticeable adverse impact on public transport services as a result of the Proposal.
- With regards to vehicular access, the Proposal will provide more direct north-south access for pedestrians and cyclists who need access to the St Marys Development Site. The proposed Links Road upgrade will include new pavement and adequate footpath and shared path which will improve the safety of pedestrians and cyclists nearby.
- Both site compound locations are easily accessible via Links Road. Detailed access arrangement will be developed at post-DA stage as part of the construction traffic management plan to ensure safety for vehicle access.
- Given the low number of vehicle movements associated with the construction activities, the impact on the surrounding network will be negligible.
- The proposed works will largely be on the west section of Links Road, which are not likely to have significant impact on nearby property access.
- Staff and visitor parking to the construction site are to be provided within the main and satellite site compound areas and across work areas as necessary. Staff and visitor parking will unlikely generate parking overspill on the surrounding road network.

Overall, the Proposal will improve accessibility to the St Marys Development Site via a new four-way signalised intersection. This signalised intersection will operate satisfactorily in future years which would otherwise fail under current priority control. With the Links Road extension and the additional lanes on Christie Street as part of the intersection upgrade at Christie Street/Lee Holm Road/Links Road, Christie Street will be able to accommodate the projected traffic volumes in future years. The Proposal is not anticipated to generate unacceptable adverse impact on the surrounding network throughout the construction period and operation.

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8 REFERENCE

- Guide to Traffic Generating Developments v2.2 (2002) and TDT 2013/04a (Roads and Traffic Authority)
- Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis, 2017
- St Marys Development Site Regional Traffic Modelling – Traffic and Transport Assessment, October 2017 (WSP)
- Central Precinct Plan and Development Control Strategy Amendment No.1, September 2018
- NSW Government Six Maps (https://maps.six.nsw.gov.au/)
- Busways Western Sydney network map, Transport for NSW.

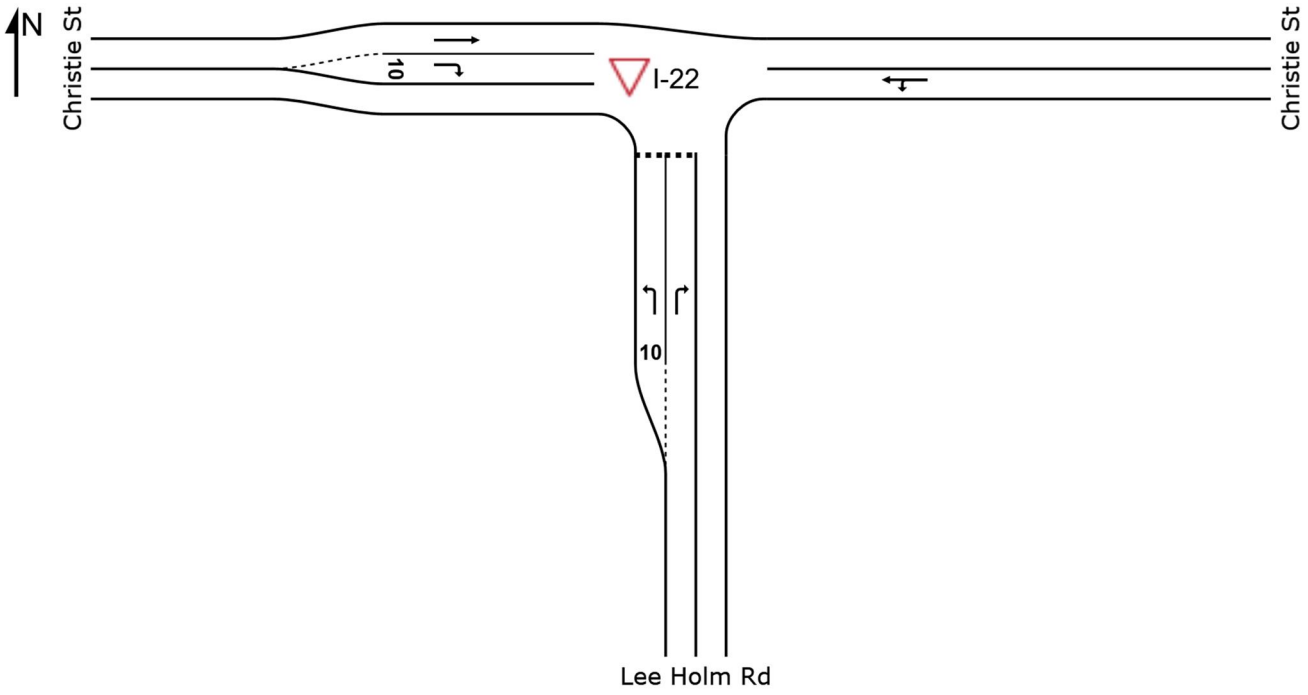
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APPENDIX A

SIDRA OUTPUT – CHRISTIE STREET/LEE HOLM ROAD INTERSECTION 2018 EXISTING CONDITIONS

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

A.1 NETWORK LAYOUT



A.2 MOVEMENT SUMMARY RESULTS

A.2.1 2018 AM PEAK

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2018 AM rev]

2018 Existing AM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	43	26.8	0.083	11.5	LOS A	0.3	2.5	0.66	0.85	46.9
3	R2	14	38.5	0.540	212.9	LOS F	1.5	14.2	0.99	1.04	10.1
Approach		57	29.6	0.540	60.0	LOS E	1.5	14.2	0.74	0.90	26.4
East: Christie St											
4	L2	43	26.8	0.430	5.9	LOS A	0.0	0.0	0.00	0.03	55.6
5	T1	747	7.7	0.430	0.1	LOS A	0.0	0.0	0.00	0.03	59.6
Approach		791	8.8	0.430	0.4	NA	0.0	0.0	0.00	0.03	59.4
West: Christie St											
11	T1	895	5.3	0.475	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
12	R2	72	16.2	0.127	11.5	LOS A	0.5	3.8	0.69	0.87	47.0
Approach		966	6.1	0.475	0.9	NA	0.5	3.8	0.05	0.06	58.7
All Vehicles		1814	8.0	0.540	2.5	NA	1.5	14.2	0.05	0.08	57.0

A.2.2 2018 PM PEAK

MOVEMENT SUMMARY

SITE: I-22 [I-22CHRISTIEST-LEEHOLMRD 2018 PM REV]

2018 Existing AM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	96	2.2	0.486	30.3	LOS C	1.7	12.2	0.93	1.04	36.9
3	R2	8	12.5	0.699	494.9	LOS F	1.8	14.3	1.00	1.04	4.9
Approach		104	3.0	0.699	67.8	LOS E	1.8	14.3	0.94	1.04	25.3
East: Christie St											
4	L2	7	28.6	0.671	6.0	LOS A	0.0	0.0	0.00	0.00	55.6
5	T1	1274	3.0	0.671	0.1	LOS A	0.0	0.0	0.00	0.00	59.6
Approach		1281	3.1	0.671	0.2	NA	0.0	0.0	0.00	0.00	59.6
West: Christie St											
11	T1	745	3.1	0.390	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	9	33.3	0.081	36.3	LOS C	0.2	2.2	0.93	0.97	33.7
Approach		755	3.5	0.390	0.5	NA	0.2	2.2	0.01	0.01	59.3
All Vehicles		2140	3.2	0.699	3.6	NA	1.8	14.3	0.05	0.06	56.0

APPENDIX B

ESTIMATED TRAFFIC VOLUMES AT CHRISTIE STREET/LEE HOLM ROAD/LINKS ROAD FOR 2021, 2026 AND 2031

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B.1 2021 VOLUMES FOR EXISTING LAYOUT WITHOUT LINKS ROAD EXTENSION

B.1.1 2021 AM PEAK WITHOUT REZONING

AM	Lee Holm Road (South)		Christie Street (East)		Christie Street (West)	
	L	R	L	T	T	R
LV	23	5	2	705	867	108
HV	27	1	0	63	45	22

B.1.2 2021 PM PEAK WITHOUT REZONING

PM	Lee Holm Road (South)		Christie Street (East)		Christie Street (West)	
	L	R	L	T	T	R
LV	82	5	0	1195	711	52
HV	30	0	0	59	30	3

B.1.3 2021 AM PEAK WITH REZONING

AM	Lee Holm Road (South)		Christie Street (East)		Christie Street (West)	
	L	R	L	T	T	R
LV	28	6	2	714	813	109
HV	32	1	0	56	38	22

B.1.4 2021 PM PEAK WITH REZONING

PM	Lee Holm Road (South)		Christie Street (East)		Christie Street (West)	
	L	R	L	T	T	R
LV	78	0	0	1185	812	49
HV	33	0	0	63	34	4

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B.2 2026 VOLUMES FOR EXISTING LAYOUT WITHOUT LINKS ROAD EXTENSION

B.2.1 2026 AM PEAK WITHOUT REZONING

AM	Lee Holm Road (South)		Christie Street (East)		Christie Street (West)	
	L	R	L	T	T	R
LV	21	0	3	841	1139	126
HV	45	0	0	61	52	24

B.2.2 2026 PM PEAK WITHOUT REZONING

PM	Lee Holm Road (South)		Christie Street (East)		Christie Street (West)	
	L	R	L	T	T	R
LV	80	6	0	1278	854	51
HV	23	0	0	54	32	2

B.2.3 2026 AM PEAK WITH REZONING

AM	Lee Holm Road (South)		Christie Street (East)		Christie Street (West)	
	L	R	L	T	T	R
LV	31	2	3	805	1056	122
HV	48	1	0	58	41	21

B.2.4 2026 PM PEAK WITH REZONING

PM	Lee Holm Road (South)		Christie Street (East)		Christie Street (West)	
	L	R	L	T	T	R
LV	80	4	0	1290	847	71
HV	28	0	0	64	33	3

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Version: 1, Version Date: 26/11/2018

B.3 2031 VOLUMES FOR EXISTING LAYOUT WITHOUT LINKS ROAD EXTENSION

B.3.1 2031 AM PEAK WITHOUT REZONING

AM	Lee Holm Road (South)		Christie Street (East)		Christie Street (West)	
	L	R	L	T	T	R
LV	53	6	4	850	1108	166
HV	46	4	0	56	54	23

B.3.2 2031 PM PEAK WITHOUT REZONING

PM	Lee Holm Road (South)		Christie Street (East)		Christie Street (West)	
	L	R	L	T	T	R
LV	104	32	3	1338	795	138
HV	28	8	1	44	26	6

B.3.3 2031 AM PEAK WITH REZONING

AM	Lee Holm Road (South)		Christie Street (East)		Christie Street (West)	
	L	R	L	T	T	R
LV	56	4	4	886	1028	143
HV	57	3	0	54	39	28

B.3.4 2031 PM PEAK WITH REZONING

PM	Lee Holm Road (South)		Christie Street (East)		Christie Street (West)	
	L	R	L	T	T	R
LV	120	30	5	1307	850	126
HV	25	2	0	50	26	5

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Version: 1, Version Date: 26/11/2018

B.4 2021 VOLUMES FOR PROPOSED LAYOUT WITH LINKS ROAD EXTENSION

B.4.1 2021 AM PEAK WITHOUT REZONING

AM	Lee Holm Road (South)			Christie Street (East)			Links Road (North)			Christie Street (West)		
	L	T	R	L	T	R	L	T	R	L	T	R
LV	18	1	1	2	631	3	13	47	97	134	734	86
HV	26	0	0	0	64	0	0	4	10	7	30	13

B.4.2 2021 PM PEAK WITHOUT REZONING

PM	Lee Holm Road (South)			Christie Street (East)			Links Road (North)			Christie Street (West)		
	L	T	R	L	T	R	L	T	R	L	T	R
LV	111	1	2	1	1084	5	10	3	108	168	640	31
HV	26	3	0	0	53	1	0	0	10	2	24	0

B.4.3 2021 AM PEAK WITH REZONING

AM	Lee Holm Road (South)			Christie Street (East)			Links Road (North)			Christie Street (West)		
	L	T	R	L	T	R	L	T	R	L	T	R
LV	27	1	1	3	604	2	23	48	167	98	766	91
HV	33	0	3	0	56	0	0	1	11	6	25	2

B.4.4 2021 PM PEAK WITH REZONING

PM	Lee Holm Road (South)			Christie Street (East)			Links Road (North)			Christie Street (West)		
	L	T	R	L	T	R	L	T	R	L	T	R
LV	89	2	1	1	1093	5	3	3	112	162	638	27
HV	30	5	0	0	50	0	0	0	11	3	32	3

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Version: 1, Version Date: 26/11/2018

B.5 2026 VOLUMES FOR PROPOSED LAYOUT WITH LINKS ROAD EXTENSION

B.5.1 2026 AM PEAK WITHOUT REZONING

AM	Lee Holm Road (South)			Christie Street (East)			Links Road (North)			Christie Street (West)		
	L	T	R	L	T	R	L	T	R	L	T	R
LV	24	2	3	7	695	10	82	55	147	85	855	85
HV	37	0	2	0	58	0	3	4	0	4	43	12

B.5.2 2026 PM PEAK WITHOUT REZONING

PM	Lee Holm Road (South)			Christie Street (East)			Links Road (North)			Christie Street (West)		
	L	T	R	L	T	R	L	T	R	L	T	R
LV	128	16	6	1	1118	11	42	1	179	135	759	31
HV	21	4	0	0	41	1	1	0	23	0	26	0

B.5.3 2026 AM PEAK WITH REZONING

AM	Lee Holm Road (South)			Christie Street (East)			Links Road (North)			Christie Street (West)		
	L	T	R	L	T	R	L	T	R	L	T	R
LV	27	2	3	2	755	4	31	51	149	50	837	88
HV	39	0	0	0	61	1	0	1	3	1	26	13

B.5.4 2026 PM PEAK WITH REZONING

PM	Lee Holm Road (South)			Christie Street (East)			Links Road (North)			Christie Street (West)		
	L	T	R	L	T	R	L	T	R	L	T	R
LV	91	9	3	1	1134	11	46	4	153	114	644	46
HV	26	5	0	0	30	1	0	0	27	1	28	0

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Version: 1, Version Date: 26/11/2018

B.6 2031 VOLUMES FOR PROPOSED LAYOUT WITH LINKS ROAD EXTENSION

B.6.1 2031 AM PEAK WITHOUT REZONING

AM	Lee Holm Road (South)			Christie Street (East)			Links Road (North)			Christie Street (West)		
	L	T	R	L	T	R	L	T	R	L	T	R
LV	40	6	1	3	682	41	66	48	270	351	979	77
HV	37	1	5	0	51	1	2	1	12	17	40	19

B.6.2 2031 PM PEAK WITHOUT REZONING

PM	Lee Holm Road (South)			Christie Street (East)			Links Road (North)			Christie Street (West)		
	L	T	R	L	T	R	L	T	R	L	T	R
LV	68	19	6	3	1303	17	14	7	166	341	739	67
HV	20	5	2	0	40	1	1	0	24	14	11	2

B.6.3 2031 AM PEAK WITH REZONING

AM	Lee Holm Road (South)			Christie Street (East)			Links Road (North)			Christie Street (West)		
	L	T	R	L	T	R	L	T	R	L	T	R
LV	37	4	2	5	790	22	41	56	293	333	923	78
HV	36	4	3	0	49	1	1	4	12	16	46	18

B.6.4 2031 PM PEAK WITH REZONING

PM	Lee Holm Road (South)			Christie Street (East)			Links Road (North)			Christie Street (West)		
	L	T	R	L	T	R	L	T	R	L	T	R
LV	89	14	3	1	1294	25	7	7	151	411	766	69
HV	20	4	0	0	38	1	0	0	23	10	20	2

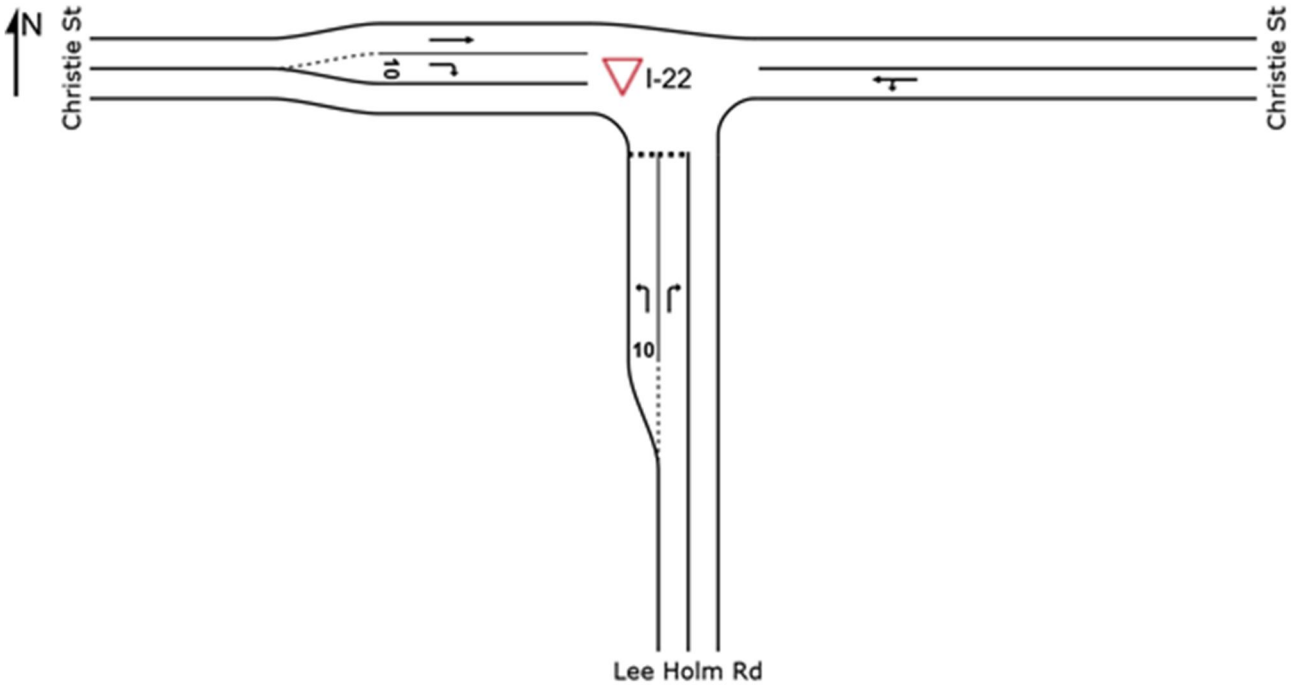
Document Set ID: 8477747
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APPENDIX C

SIDRA OUTPUT – CHRISTIE STREET/LEE HOLM ROAD INTERSECTION FUTURE PERFORMANCE (2021, 2026 AND 2031) EXISTING LAYOUT WITHOUT LINKS ROAD EXTENSION

Document Set ID: 8477747
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C.1 NETWORK LAYOUT



C.2 2021 MOVEMENT SUMMARY RESULTS

C.2.1 2021 AM PEAK WITHOUT REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2021 AM without rezoning]

2021 Base AM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	50	54.0	0.130	14.5	LOS B	0.4	4.6	0.73	0.88	44.1
3	R2	6	16.7	0.179	111.9	LOS F	0.5	3.8	0.97	0.99	16.5
Approach		56	50.0	0.179	25.0	LOS B	0.5	4.6	0.76	0.89	38.2
East: Christie St											
4	L2	2	0.0	0.416	5.6	LOS A	0.0	0.0	0.00	0.00	57.7
5	T1	768	8.2	0.416	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		770	8.2	0.416	0.1	NA	0.0	0.0	0.00	0.00	59.9
West: Christie St											
11	T1	912	4.9	0.483	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
12	R2	130	16.9	0.222	11.6	LOS A	0.9	7.2	0.70	0.89	46.8
Approach		1042	6.4	0.483	1.5	NA	0.9	7.2	0.09	0.11	57.9
All Vehicles		1868	8.5	0.483	1.6	NA	0.9	7.2	0.07	0.09	57.8

C.2.2 2021 PM PEAK WITHOUT REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2021 PM without rezoning]

2021 Base PM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	112	26.8	0.840	77.8	LOS F	4.0	34.9	0.98	1.30	23.3
3	R2	5	0.0	0.292	237.7	LOS F	0.7	5.2	0.99	1.01	9.3
Approach		117	25.6	0.840	84.7	LOS F	4.0	34.9	0.98	1.29	22.1
East: Christie St											
4	L2	1	0.0	0.663	5.6	LOS A	0.0	0.0	0.00	0.00	57.5
5	T1	1254	4.7	0.663	0.1	LOS A	0.0	0.0	0.00	0.00	59.7
Approach		1255	4.7	0.663	0.1	NA	0.0	0.0	0.00	0.00	59.7
West: Christie St											
11	T1	741	4.0	0.390	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	55	5.5	0.272	26.3	LOS B	0.9	6.7	0.91	0.99	38.5
Approach		796	4.1	0.390	1.9	NA	0.9	6.7	0.06	0.07	57.8
All Vehicles		2168	5.6	0.840	5.3	NA	4.0	34.9	0.08	0.09	54.3

C.2.3 2021 AM PEAK WITH REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2021 AM with rezoning]

2021 Base AM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	60	53.3	0.154	14.5	LOS B	0.5	5.5	0.73	0.88	44.1
3	R2	7	14.3	0.159	85.6	LOS F	0.4	3.4	0.97	0.99	19.9
Approach		67	49.3	0.159	22.0	LOS B	0.5	5.5	0.76	0.90	39.7
East: Christie St											
4	L2	2	0.0	0.415	5.6	LOS A	0.0	0.0	0.00	0.00	57.7
5	T1	770	7.3	0.415	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		772	7.3	0.415	0.1	NA	0.0	0.0	0.00	0.00	59.9
West: Christie St											
11	T1	851	4.5	0.449	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	131	16.8	0.222	11.6	LOS A	0.9	7.2	0.70	0.89	46.8
Approach		982	6.1	0.449	1.6	NA	0.9	7.2	0.09	0.12	57.8
All Vehicles		1821	8.2	0.449	1.7	NA	0.9	7.2	0.08	0.10	57.7

C.2.4 2021 PM PEAK WITH REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2021 PM with rezoning]

2021 Base PM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	111	29.7	0.862	86.3	LOS F	4.4	38.3	0.99	1.34	21.9
3	R2	1	0.0	0.076	239.6	LOS F	0.2	1.3	0.99	1.00	9.2
Approach		112	29.5	0.862	87.7	LOS F	4.4	38.3	0.99	1.34	21.7
East: Christie St											
4	L2	1	0.0	0.662	5.6	LOS A	0.0	0.0	0.00	0.00	57.5
5	T1	1248	5.0	0.662	0.1	LOS A	0.0	0.0	0.00	0.00	59.7
Approach		1249	5.0	0.662	0.1	NA	0.0	0.0	0.00	0.00	59.7
West: Christie St											
11	T1	846	4.0	0.445	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	53	7.5	0.268	26.7	LOS B	0.9	6.7	0.91	0.99	38.3
Approach		899	4.2	0.445	1.6	NA	0.9	6.7	0.05	0.06	58.0
All Vehicles		2260	5.9	0.862	5.1	NA	4.4	38.3	0.07	0.09	54.5

C.3 2026 MOVEMENT SUMMARY RESULTS

C.3.1 2026 AM PEAK WITHOUT REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2026 AM without rezoning]

2026 Base AM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	66	68.2	0.274	22.9	LOS B	1.0	10.9	0.85	0.97	39.0
3	R2	1	0.0	0.086	267.1	LOS F	0.2	1.4	0.99	1.00	8.4
Approach		67	67.2	0.274	26.6	LOS B	1.0	10.9	0.85	0.97	37.3
East: Christie St											
4	L2	3	0.0	0.485	5.6	LOS A	0.0	0.0	0.00	0.00	57.6
5	T1	902	6.8	0.485	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
Approach		905	6.7	0.485	0.1	NA	0.0	0.0	0.00	0.00	59.8
West: Christie St											
11	T1	1191	4.4	0.851	1.6	LOS A	8.4	60.7	0.62	0.00	57.0
12	R2	150	16.0	0.332	15.3	LOS B	1.4	11.4	0.80	0.97	44.4
Approach		1341	5.7	0.851	3.1	NA	8.4	60.7	0.64	0.11	55.3
All Vehicles		2313	7.9	0.851	2.6	NA	8.4	60.7	0.39	0.09	56.2

C.3.2 2026 PM PEAK WITHOUT REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2026 PM without rezoning]

2026 Base PM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	103	22.3	0.969	159.6	LOS F	7.0	58.6	1.00	1.64	14.4
3	R2	6	0.0	0.748	833.2	LOS F	1.9	13.4	1.00	1.04	3.0
Approach		109	21.1	0.969	196.7	LOS F	7.0	58.6	1.00	1.61	12.2
East: Christie St											
4	L2	1	0.0	0.702	5.7	LOS A	0.0	0.0	0.00	0.00	57.5
5	T1	1332	4.1	0.702	0.2	LOS A	0.0	0.0	0.00	0.00	59.6
Approach		1333	4.1	0.702	0.2	NA	0.0	0.0	0.00	0.00	59.6
West: Christie St											
11	T1	886	3.6	0.465	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	53	3.8	0.335	33.5	LOS C	1.1	7.9	0.94	1.01	35.4
Approach		939	3.6	0.465	2.0	NA	1.1	7.9	0.05	0.06	57.7
All Vehicles		2381	4.7	0.969	9.9	NA	7.0	58.6	0.07	0.10	50.4

C.3.3 2026 AM PEAK WITH REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2026 AM with rezoning]

2026 Base AM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	79	60.8	0.273	19.8	LOS B	1.0	10.7	0.82	0.96	40.8
3	R2	3	33.3	0.371	541.8	LOS F	0.9	8.1	1.00	1.01	4.5
Approach		82	59.8	0.371	38.9	LOS C	1.0	10.7	0.83	0.96	32.5
East: Christie St											
4	L2	3	0.0	0.464	5.6	LOS A	0.0	0.0	0.00	0.00	57.6
5	T1	863	6.7	0.464	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
Approach		866	6.7	0.464	0.1	NA	0.0	0.0	0.00	0.00	59.8
West: Christie St											
11	T1	1097	3.7	0.743	0.7	LOS A	4.7	34.2	0.52	0.00	57.4
12	R2	143	14.7	0.286	13.7	LOS A	1.2	9.6	0.77	0.94	45.5
Approach		1240	5.0	0.743	2.2	NA	4.7	34.2	0.55	0.11	55.8
All Vehicles		2188	7.7	0.743	2.7	NA	4.7	34.2	0.34	0.10	55.9

C.3.4 2026 PM PEAK WITH REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2026 PM with rezoning]

2026 Base PM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	108	25.9	1.227	512.6	LOS F	29.7	254.1	1.00	3.27	5.4
3	R2	4	0.0	0.587	811.1	LOS F	1.4	10.0	1.00	1.02	3.1
Approach		112	25.0	1.227	523.3	LOS F	29.7	254.1	1.00	3.19	5.2
East: Christie St											
4	L2	1	0.0	0.716	5.7	LOS A	0.0	0.0	0.00	0.00	57.4
5	T1	1354	4.7	0.716	0.2	LOS A	0.0	0.0	0.00	0.00	59.6
Approach		1355	4.7	0.716	0.2	NA	0.0	0.0	0.00	0.00	59.6
West: Christie St											
11	T1	880	3.8	0.791	11.6	LOS A	28.4	205.1	1.00	0.00	49.3
12	R2	74	4.1	0.523	44.0	LOS D	1.8	13.2	0.96	1.05	31.6
Approach		954	3.8	0.791	14.1	NA	28.4	205.1	1.00	0.08	47.4
All Vehicles		2421	5.3	1.227	29.9	NA	29.7	254.1	0.44	0.18	38.2

C.4 2031 MOVEMENT SUMMARY RESULTS

C.4.1 2031 AM PEAK WITHOUT REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2031 AM without rezoning]

2031 Base AM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	99	46.5	0.327	19.8	LOS B	1.3	12.3	0.83	0.98	41.1
3	R2	10	40.0	1.667	2034.4	LOS F	8.9	84.0	1.00	1.39	1.2
Approach		109	45.9	1.667	204.6	LOS F	8.9	84.0	0.85	1.02	11.0
East: Christie St											
4	L2	4	0.0	0.485	5.6	LOS A	0.0	0.0	0.00	0.00	57.6
5	T1	906	6.2	0.485	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
Approach		910	6.2	0.485	0.1	NA	0.0	0.0	0.00	0.00	59.8
West: Christie St											
11	T1	1162	4.6	0.894	3.7	LOS A	12.5	91.2	0.68	0.00	56.1
12	R2	189	12.2	0.403	15.7	LOS B	1.9	14.5	0.81	1.00	44.3
Approach		1351	5.7	0.894	5.4	NA	12.5	91.2	0.69	0.14	54.2
All Vehicles		2370	7.7	1.667	12.5	NA	12.5	91.2	0.44	0.13	47.7

C.4.2 2031 PM PEAK WITHOUT REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2031 PM without rezoning]

2031 Base PM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	132	21.2	1.484	943.8	LOS F	58.7	485.3	1.00	4.74	3.0
3	R2	40	20.0	6.667	10493.2	LOS F	57.3	470.0	1.00	1.73	0.2
Approach		172	20.9	6.667	3164.6	LOS F	58.7	485.3	1.00	4.04	0.9
East: Christie St											
4	L2	4	25.0	0.726	6.0	LOS A	0.0	0.0	0.00	0.00	55.8
5	T1	1382	3.2	0.726	0.2	LOS A	0.0	0.0	0.00	0.00	59.6
Approach		1386	3.2	0.726	0.2	NA	0.0	0.0	0.00	0.00	59.5
West: Christie St											
11	T1	821	3.2	1.212	519.4	LOS F	294.4	2116.6	1.00	0.00	5.6
12	R2	144	4.2	1.116	315.5	LOS F	24.8	179.9	1.00	2.89	8.3
Approach		965	3.3	1.212	489.0	NA	294.4	2116.6	1.00	0.43	5.8
All Vehicles		2523	4.5	6.667	402.9	NA	294.4	2116.6	0.45	0.44	6.8

C.4.3 2031 AM PEAK WITH REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2031 AM with rezoning]

2031 Base AM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	113	50.4	0.426	23.7	LOS B	1.7	17.1	0.87	1.03	39.0
3	R2	7	42.9	1.167	1475.3	LOS F	4.3	41.4	1.00	1.19	1.6
Approach		120	50.0	1.167	108.4	LOS F	4.3	41.4	0.88	1.04	18.2
East: Christie St											
4	L2	4	0.0	0.502	5.6	LOS A	0.0	0.0	0.00	0.00	57.6
5	T1	940	5.7	0.502	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
Approach		944	5.7	0.502	0.1	NA	0.0	0.0	0.00	0.00	59.8
West: Christie St											
11	T1	1067	3.7	0.838	3.6	LOS A	11.2	80.9	0.69	0.00	56.3
12	R2	171	16.4	0.412	17.3	LOS B	1.9	14.9	0.84	1.02	43.1
Approach		1238	5.4	0.838	5.4	NA	11.2	80.9	0.71	0.14	54.1
All Vehicles		2302	7.9	1.167	8.6	NA	11.2	80.9	0.43	0.13	51.1

C.4.4 2031 PM PEAK WITH REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd 2031 PM with rezoning]

2031 Base PM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

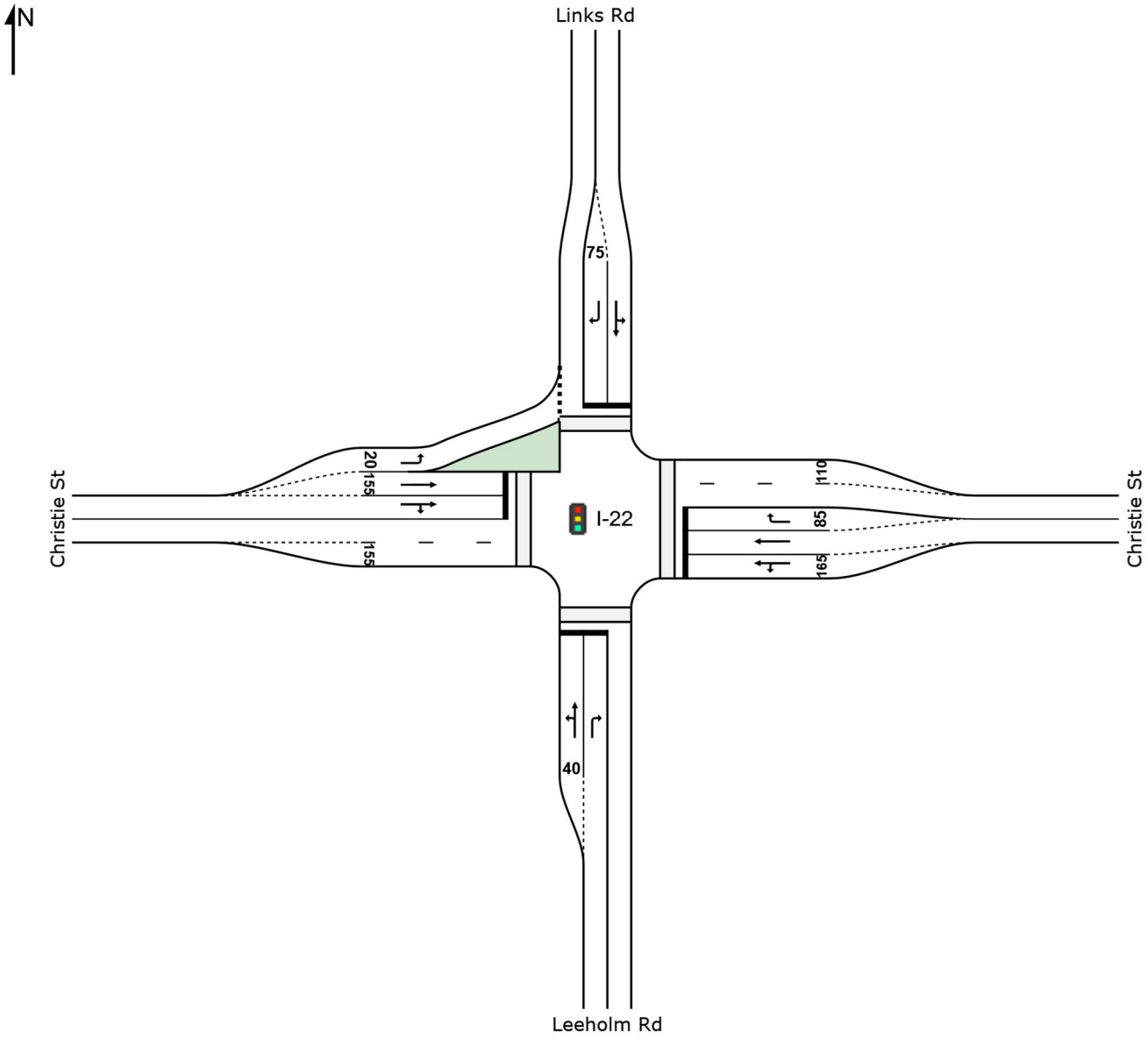
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Lee Holm Rd											
1	L2	145	17.2	1.367	729.4	LOS F	53.5	429.6	1.00	4.61	3.9
3	R2	32	6.3	5.333	8159.5	LOS F	44.6	329.3	1.00	1.66	0.3
Approach		177	15.3	5.333	2072.7	LOS F	53.5	429.6	1.00	4.08	1.4
East: Christie St											
4	L2	5	0.0	0.715	5.7	LOS A	0.0	0.0	0.00	0.00	57.4
5	T1	1357	3.7	0.715	0.2	LOS A	0.0	0.0	0.00	0.00	59.6
Approach		1362	3.7	0.715	0.2	NA	0.0	0.0	0.00	0.00	59.6
West: Christie St											
11	T1	876	3.0	1.091	327.7	LOS F	243.9	1751.1	1.00	0.00	8.4
12	R2	131	3.8	0.922	108.6	LOS F	6.0	43.2	0.99	1.48	19.0
Approach		1007	3.1	1.091	299.2	NA	243.9	1751.1	1.00	0.19	9.0
All Vehicles		2546	4.2	5.333	262.5	NA	243.9	1751.1	0.46	0.36	9.9

APPENDIX D

SIDRA OUTPUT – CHRISTIE STREET/LEE HOLM ROAD/LINKS ROAD INTERSECTION FUTURE PERFORMANCE (2021, 2026 AND 2031) NEW LAYOUT WITH LINKS ROAD EXTENSION

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

D.1 NETWORK LAYOUT



Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

D.2 2021 MOVEMENT SUMMARY RESULTS

D.2.1 2021 AM PEAK WITHOUT REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd-LinksRd-2021 AM without rezoning]

Christie St & Leeholm Rd & Link Rd
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Leeholm Rd											
1	L2	44	59.1	0.210	37.9	LOS D	1.6	16.8	0.90	0.73	31.5
2	T1	1	0.0	0.210	32.9	LOS C	1.6	16.8	0.90	0.73	31.2
3	R2	1	0.0	0.004	36.9	LOS D	0.0	0.2	0.88	0.59	30.5
Approach		46	56.5	0.210	37.8	LOS D	1.6	16.8	0.90	0.73	31.5
East: Christie St											
4	L2	2	0.0	0.249	10.6	LOS B	4.6	34.6	0.40	0.35	49.0
5	T1	695	9.2	0.302	5.1	LOS A	5.8	43.9	0.41	0.36	54.7
6	R2	3	0.0	0.007	13.8	LOS B	0.1	0.4	0.45	0.62	43.4
Approach		700	9.1	0.302	5.2	LOS A	5.8	43.9	0.41	0.36	54.7
North: Links Rd											
7	L2	13	0.0	0.212	36.8	LOS D	2.2	16.5	0.90	0.70	34.0
8	T1	51	7.8	0.212	32.3	LOS C	2.2	16.5	0.90	0.70	32.5
9	R2	107	9.3	0.497	41.0	LOS D	4.1	31.0	0.97	0.78	33.2
Approach		171	8.2	0.497	38.1	LOS D	4.1	31.0	0.95	0.75	33.1
West: Christie St											
10	L2	141	5.0	0.101	6.2	LOS A	0.5	3.4	0.17	0.59	50.0
11	T1	764	3.9	0.536	6.4	LOS A	9.9	72.5	0.49	0.46	53.1
12	R2	99	13.1	0.536	13.3	LOS B	9.9	72.5	0.56	0.56	47.2
Approach		1004	5.0	0.536	7.1	LOS A	9.9	72.5	0.45	0.49	52.0
All Vehicles		1921	8.0	0.536	9.9	LOS A	9.9	72.5	0.49	0.47	49.5

D.2.2 2021 PM PEAK WITHOUT REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd-LinksRd-2021 PM without rezoning]

Christie St & Leeholm Rd & Link Rd
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Leeholm Rd											
1	L2	137	19.0	0.386	33.9	LOS C	4.8	39.7	0.89	0.78	33.5
2	T1	4	75.0	0.386	29.2	LOS C	4.8	39.7	0.89	0.78	32.3
3	R2	2	0.0	0.006	30.4	LOS C	0.1	0.4	0.79	0.61	32.9
Approach		143	20.3	0.386	33.7	LOS C	4.8	39.7	0.89	0.78	33.4
East: Christie St											
4	L2	1	0.0	0.435	13.8	LOS B	10.3	74.7	0.55	0.49	46.3
5	T1	1137	4.7	0.527	8.6	LOS A	13.5	98.6	0.58	0.52	51.7

6	R2	6	16.7	0.017	17.3	LOS B	0.1	1.0	0.53	0.64	41.4
Approach		1144	4.7	0.527	8.7	LOS A	13.5	98.6	0.58	0.52	51.6
North: Links Rd											
7	L2	10	0.0	0.031	30.7	LOS C	0.4	2.8	0.81	0.64	35.3
8	T1	3	0.0	0.031	26.1	LOS C	0.4	2.8	0.81	0.64	33.8
9	R2	118	8.5	0.522	39.6	LOS D	4.5	33.5	0.96	0.79	33.6
Approach		131	7.6	0.522	38.6	LOS D	4.5	33.5	0.95	0.78	33.8
West: Christie St											
10	L2	170	1.2	0.120	6.2	LOS A	0.6	4.0	0.18	0.60	50.0
11	T1	664	3.6	0.441	8.6	LOS A	8.7	62.4	0.54	0.48	51.5
12	R2	31	0.0	0.441	15.4	LOS B	8.7	62.4	0.60	0.54	46.3
Approach		865	3.0	0.441	8.4	LOS A	8.7	62.4	0.47	0.51	51.0
All Vehicles		2283	5.2	0.527	11.9	LOS B	13.5	98.6	0.58	0.55	48.2

D.2.3 2021 AM PEAK WITH REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd-LinksRd-2021 AM with rezoning]

Christie St & Leeholm Rd & Link Rd
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Leeholm Rd											
1	L2	60	55.0	0.192	32.1	LOS C	2.0	20.1	0.84	0.73	33.6
2	T1	1	0.0	0.192	27.1	LOS C	2.0	20.1	0.84	0.73	33.1
3	R2	4	75.0	0.017	32.6	LOS C	0.1	1.4	0.81	0.63	30.8
Approach		65	55.4	0.192	32.1	LOS C	2.0	20.1	0.83	0.73	33.4
East: Christie St											
4	L2	3	0.0	0.265	13.2	LOS B	5.4	40.2	0.49	0.43	46.7
5	T1	660	8.5	0.321	7.8	LOS A	6.8	51.0	0.51	0.44	52.3
6	R2	2	0.0	0.006	18.1	LOS B	0.0	0.3	0.55	0.62	41.0
Approach		665	8.4	0.321	7.9	LOS A	6.8	51.0	0.51	0.44	52.3
North: Links Rd											
7	L2	23	0.0	0.159	30.9	LOS C	2.3	16.0	0.83	0.67	36.1
8	T1	49	2.0	0.159	26.4	LOS C	2.3	16.0	0.83	0.67	34.5
9	R2	178	6.2	0.591	36.6	LOS D	6.6	48.3	0.95	0.81	34.6
Approach		250	4.8	0.591	34.1	LOS C	6.6	48.3	0.92	0.77	34.7
West: Christie St											
10	L2	104	5.8	0.075	6.2	LOS A	0.3	2.4	0.17	0.59	50.0
11	T1	791	3.2	0.592	9.7	LOS A	12.8	91.6	0.60	0.55	50.4
12	R2	93	2.2	0.592	16.9	LOS B	12.8	91.6	0.68	0.64	44.9
Approach		988	3.3	0.592	10.0	LOS B	12.8	91.6	0.56	0.56	49.8
All Vehicles		1968	7.0	0.592	13.1	LOS B	12.8	91.6	0.60	0.55	47.0

D.2.4 2021 PM PEAK WITH REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd-LinksRd-2021 PM with rezoning]

Christie St & Leeholm Rd & Link Rd
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Leeholm Rd											
1	L2	119	25.2	0.359	33.8	LOS C	4.3	37.1	0.89	0.77	33.4
2	T1	7	71.4	0.359	29.1	LOS C	4.3	37.1	0.89	0.77	32.4
3	R2	1	0.0	0.003	30.2	LOS C	0.0	0.2	0.79	0.59	33.0
Approach		127	27.6	0.359	33.5	LOS C	4.3	37.1	0.89	0.77	33.3
East: Christie St											
4	L2	1	0.0	0.436	13.8	LOS B	10.3	75.0	0.55	0.49	46.3
5	T1	1143	4.4	0.529	8.7	LOS A	13.6	99.0	0.58	0.52	51.6
6	R2	5	0.0	0.013	17.0	LOS B	0.1	0.7	0.53	0.64	41.6
Approach		1149	4.4	0.529	8.7	LOS A	13.6	99.0	0.58	0.52	51.6
North: Links Rd											
7	L2	3	0.0	0.014	30.4	LOS C	0.2	1.3	0.80	0.59	35.9
8	T1	3	0.0	0.014	25.9	LOS C	0.2	1.3	0.80	0.59	34.3
9	R2	123	8.9	0.527	39.5	LOS D	4.6	35.0	0.96	0.79	33.6
Approach		129	8.5	0.527	39.0	LOS D	4.6	35.0	0.95	0.78	33.7
West: Christie St											
10	L2	165	1.8	0.117	6.2	LOS A	0.6	3.9	0.18	0.60	50.0
11	T1	670	4.8	0.452	8.7	LOS A	8.8	64.5	0.55	0.49	51.4
12	R2	30	10.0	0.452	15.7	LOS B	8.8	64.5	0.60	0.55	46.1
Approach		865	4.4	0.452	8.5	LOS A	8.8	64.5	0.48	0.51	50.9
All Vehicles		2270	5.9	0.529	11.7	LOS B	13.6	99.0	0.58	0.55	48.3

D.3 2026 MOVEMENT SUMMARY RESULTS

D.3.1 2026 AM PEAK WITHOUT REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd-LinksRd-2026 AM without rezoning]

Christie St & Leeholm Rd & Link Rd
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Leeholm Rd											
1	L2	61	60.7	0.240	35.3	LOS D	2.2	22.7	0.88	0.74	32.4
2	T1	2	0.0	0.240	30.2	LOS C	2.2	22.7	0.88	0.74	32.1
3	R2	5	40.0	0.028	38.2	LOS D	0.2	1.6	0.89	0.65	29.4
Approach		68	57.4	0.240	35.3	LOS D	2.2	22.7	0.88	0.74	32.2
East: Christie St											
4	L2	7	0.0	0.284	11.9	LOS B	5.7	42.4	0.46	0.41	47.7
5	T1	753	7.7	0.345	6.6	LOS A	7.3	54.3	0.47	0.42	53.4
6	R2	10	0.0	0.032	17.9	LOS B	0.2	1.5	0.55	0.66	41.2
Approach		770	7.5	0.345	6.8	LOS A	7.3	54.3	0.47	0.42	53.1
North: Links Rd											
7	L2	85	3.5	0.393	35.4	LOS D	5.0	36.6	0.91	0.76	33.8
8	T1	59	6.8	0.393	30.8	LOS C	5.0	36.6	0.91	0.76	32.4

9	R2	155	5.2	0.620	40.4	LOS D	6.0	43.9	0.98	0.83	33.4
Approach		299	5.0	0.620	37.1	LOS D	6.0	43.9	0.95	0.80	33.3
West: Christie St											
10	L2	89	4.5	0.064	6.2	LOS A	0.3	2.1	0.17	0.59	50.0
11	T1	898	4.8	0.652	8.6	LOS A	14.0	103.2	0.59	0.54	51.3
12	R2	97	12.4	0.652	16.0	LOS B	14.0	103.2	0.68	0.65	45.5
Approach		1084	5.4	0.652	9.1	LOS A	14.0	103.2	0.56	0.56	50.7
All Vehicles		2221	7.7	0.652	12.8	LOS B	14.0	103.2	0.59	0.55	47.2

D.3.2 2026 PM PEAK WITHOUT REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd-LinksRd-2026 PM without rezoning]

Christie St & Leeholm Rd & Link Rd
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Leeholm Rd											
1	L2	149	14.1	0.307	26.8	LOS C	5.0	39.5	0.79	0.75	36.6
2	T1	20	20.0	0.307	22.1	LOS C	5.0	39.5	0.79	0.75	35.1
3	R2	6	0.0	0.013	24.9	LOS C	0.2	1.1	0.71	0.63	35.3
Approach		175	14.3	0.307	26.2	LOS C	5.0	39.5	0.79	0.75	36.4
East: Christie St											
4	L2	1	0.0	0.524	18.9	LOS B	13.4	96.5	0.70	0.62	42.5
5	T1	1159	3.5	0.636	14.0	LOS B	17.7	127.6	0.74	0.66	47.5
6	R2	12	8.3	0.053	27.9	LOS C	0.3	2.6	0.74	0.69	36.4
Approach		1172	3.6	0.636	14.2	LOS B	17.7	127.6	0.74	0.66	47.4
North: Links Rd											
7	L2	43	2.3	0.074	24.7	LOS C	1.2	8.5	0.72	0.69	37.4
8	T1	1	0.0	0.074	20.1	LOS C	1.2	8.5	0.72	0.69	35.8
9	R2	202	11.4	0.618	34.1	LOS C	7.3	56.1	0.93	0.83	35.4
Approach		246	9.8	0.618	32.4	LOS C	7.3	56.1	0.89	0.80	35.7
West: Christie St											
10	L2	135	0.0	0.095	6.1	LOS A	0.4	3.1	0.17	0.60	50.1
11	T1	785	3.3	0.635	15.2	LOS B	14.8	106.1	0.73	0.64	46.6
12	R2	31	0.0	0.635	23.3	LOS C	14.8	106.1	0.82	0.73	41.4
Approach		951	2.7	0.635	14.2	LOS B	14.8	106.1	0.65	0.64	46.9
All Vehicles		2544	4.6	0.636	16.8	LOS B	17.7	127.6	0.73	0.67	44.8

D.3.3 2026 AM PEAK WITH REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd-LinksRd-2026 AM with rezoning]

Christie St & Leeholm Rd & Link Rd
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

		Demand Flows					95% Back of Queue				

Mov ID	OD Mov	Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Leeholm Rd											
1	L2	66	59.1	0.258	35.4	LOS D	2.3	24.4	0.88	0.75	32.4
2	T1	2	0.0	0.258	30.3	LOS C	2.3	24.4	0.88	0.75	32.0
3	R2	3	0.0	0.012	34.3	LOS C	0.1	0.7	0.85	0.62	31.4
Approach		71	54.9	0.258	35.2	LOS D	2.3	24.4	0.88	0.74	32.3
East: Christie St											
4	L2	2	0.0	0.306	12.1	LOS B	6.2	46.4	0.47	0.41	47.7
5	T1	816	7.5	0.371	6.7	LOS A	8.0	59.6	0.48	0.42	53.3
6	R2	5	20.0	0.018	17.4	LOS B	0.1	0.8	0.53	0.64	41.2
Approach		823	7.5	0.371	6.8	LOS A	8.0	59.6	0.48	0.43	53.2
North: Links Rd											
7	L2	31	0.0	0.218	34.0	LOS C	2.8	19.6	0.88	0.71	34.8
8	T1	52	1.9	0.218	29.5	LOS C	2.8	19.6	0.88	0.71	33.2
9	R2	152	2.0	0.611	40.3	LOS D	5.9	41.8	0.98	0.82	33.5
Approach		235	1.7	0.611	37.1	LOS D	5.9	41.8	0.94	0.78	33.6
West: Christie St											
10	L2	51	2.0	0.036	6.1	LOS A	0.2	1.1	0.16	0.58	50.1
11	T1	863	3.0	0.642	8.7	LOS A	13.0	95.0	0.59	0.54	51.2
12	R2	101	12.9	0.642	16.4	LOS B	13.0	95.0	0.69	0.66	45.1
Approach		1015	3.9	0.642	9.4	LOS A	13.0	95.0	0.57	0.55	50.5
All Vehicles		2144	6.8	0.642	12.3	LOS B	13.0	95.0	0.59	0.54	47.8

D.3.4 2026 PM PEAK WITH REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd-LinksRd-2026 PM with rezoning]

Christie St & Leeholm Rd & Link Rd
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Leeholm Rd											
1	L2	117	22.2	0.285	29.0	LOS C	4.0	34.1	0.82	0.75	35.4
2	T1	14	35.7	0.285	24.3	LOS C	4.0	34.1	0.82	0.75	34.2
3	R2	3	0.0	0.007	27.1	LOS C	0.1	0.6	0.74	0.62	34.3
Approach		134	23.1	0.285	28.5	LOS C	4.0	34.1	0.82	0.75	35.3
East: Christie St											
4	L2	1	0.0	0.488	16.9	LOS B	12.3	88.2	0.65	0.58	43.9
5	T1	1164	2.6	0.592	11.9	LOS B	16.3	116.7	0.68	0.61	49.1
6	R2	12	8.3	0.041	23.8	LOS C	0.3	2.3	0.67	0.68	38.2
Approach		1177	2.6	0.592	12.0	LOS B	16.3	116.7	0.68	0.61	49.0
North: Links Rd											
7	L2	46	0.0	0.093	27.1	LOS C	1.4	10.0	0.76	0.70	36.5
8	T1	4	0.0	0.093	22.6	LOS C	1.4	10.0	0.76	0.70	34.9
9	R2	180	15.0	0.598	36.1	LOS D	6.6	52.2	0.95	0.82	34.7
Approach		230	11.7	0.598	34.0	LOS C	6.6	52.2	0.91	0.79	35.0
West: Christie St											
10	L2	115	0.9	0.081	6.1	LOS A	0.4	2.6	0.17	0.59	50.1
11	T1	672	4.2	0.566	13.3	LOS B	11.3	81.5	0.67	0.59	47.8
12	R2	46	0.0	0.566	22.0	LOS C	11.3	81.5	0.77	0.69	42.0

Approach	833	3.5	0.566	12.8	LOS B	11.3	81.5	0.61	0.60	47.8
All Vehicles	2374	5.0	0.598	15.3	LOS B	16.3	116.7	0.68	0.63	45.7

D.4 2031 MOVEMENT SUMMARY RESULTS

D.4.1 2031 AM PEAK WITHOUT REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd-LinksRd-2031 AM without rezoning]

Christie St & Leeholm Rd & Link Rd
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Leeholm Rd											
1	L2	77	48.1	0.227	30.6	LOS C	2.6	25.6	0.82	0.74	34.4
2	T1	7	14.3	0.227	25.6	LOS C	2.6	25.6	0.82	0.74	33.8
3	R2	6	83.3	0.026	32.0	LOS C	0.2	2.3	0.80	0.65	30.9
Approach		90	47.8	0.227	30.3	LOS C	2.6	25.6	0.82	0.73	34.2
East: Christie St											
4	L2	3	0.0	0.303	14.4	LOS B	6.5	47.9	0.54	0.47	45.8
5	T1	733	7.0	0.368	9.1	LOS A	8.2	61.1	0.55	0.48	51.3
6	R2	42	2.4	0.221	30.5	LOS C	1.3	9.5	0.80	0.74	35.4
Approach		778	6.7	0.368	10.3	LOS B	8.2	61.1	0.56	0.50	50.0
North: Links Rd											
7	L2	68	2.9	0.239	29.9	LOS C	3.6	26.1	0.83	0.72	35.9
8	T1	49	2.0	0.239	25.4	LOS C	3.6	26.1	0.83	0.72	34.4
9	R2	282	4.3	0.890	52.3	LOS D	13.8	100.0	1.00	1.10	30.2
Approach		399	3.8	0.890	45.2	LOS D	13.8	100.0	0.95	0.98	31.4
West: Christie St											
10	L2	368	4.6	0.270	6.7	LOS A	2.1	15.0	0.26	0.63	49.7
11	T1	1019	3.9	0.874	21.3	LOS C	31.8	233.8	0.79	0.81	42.7
12	R2	96	19.8	0.874	34.5	LOS C	31.8	233.8	0.93	1.02	35.8
Approach		1483	5.1	0.874	18.5	LOS B	31.8	233.8	0.67	0.78	43.9
All Vehicles		2750	6.8	0.890	20.4	LOS C	31.8	233.8	0.68	0.73	42.4

D.4.2 2031 PM PEAK WITHOUT REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd-LinksRd-2031 PM without rezoning]

Christie St & Leeholm Rd & Link Rd
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Leeholm Rd											
1	L2	88	22.7	0.291	32.4	LOS C	3.7	30.6	0.86	0.75	34.3

2	T1	24	20.8	0.291	27.6	LOS C	3.7	30.6	0.86	0.75	33.2
3	R2	8	25.0	0.025	30.3	LOS C	0.2	2.1	0.79	0.65	32.5
Approach		120	22.5	0.291	31.3	LOS C	3.7	30.6	0.86	0.74	34.0
East: Christie St											
4	L2	3	0.0	0.519	15.0	LOS B	13.4	96.2	0.61	0.55	45.3
5	T1	1343	3.0	0.630	10.0	LOS B	18.1	129.9	0.65	0.59	50.6
6	R2	18	5.6	0.065	24.8	LOS C	0.5	3.5	0.69	0.69	37.8
Approach		1364	3.0	0.630	10.2	LOS B	18.1	129.9	0.65	0.59	50.3
North: Links Rd											
7	L2	15	6.7	0.051	30.1	LOS C	0.7	4.8	0.80	0.65	35.6
8	T1	7	0.0	0.051	25.5	LOS C	0.7	4.8	0.80	0.65	34.2
9	R2	190	12.6	0.731	41.8	LOS D	7.7	60.0	0.99	0.90	32.9
Approach		212	11.8	0.731	40.4	LOS D	7.7	60.0	0.97	0.88	33.1
West: Christie St											
10	L2	355	3.9	0.254	6.4	LOS A	1.5	11.1	0.22	0.62	49.9
11	T1	750	1.5	0.728	13.8	LOS B	14.9	105.9	0.69	0.63	47.4
12	R2	69	2.9	0.728	25.0	LOS C	14.9	105.9	0.85	0.81	40.2
Approach		1174	2.3	0.728	12.2	LOS B	14.9	105.9	0.56	0.63	47.7
All Vehicles		2870	4.2	0.731	14.1	LOS B	18.1	129.9	0.64	0.64	46.5

D.4.3 2031 AM PEAK WITH REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd-LinksRd-2031 AM with rezoning]

Christie St & Leeholm Rd & Link Rd
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Leeholm Rd											
1	L2	73	49.3	0.213	29.6	LOS C	2.5	24.9	0.81	0.73	34.7
2	T1	8	50.0	0.213	24.6	LOS C	2.5	24.9	0.81	0.73	34.1
3	R2	5	60.0	0.019	30.7	LOS C	0.2	1.6	0.79	0.64	31.8
Approach		86	50.0	0.213	29.2	LOS C	2.5	24.9	0.81	0.72	34.5
East: Christie St											
4	L2	5	0.0	0.353	15.2	LOS B	7.9	57.9	0.57	0.50	45.1
5	T1	839	5.8	0.428	10.0	LOS B	10.1	74.5	0.59	0.52	50.5
6	R2	23	4.3	0.122	30.4	LOS C	0.7	5.2	0.78	0.72	35.5
Approach		867	5.8	0.428	10.6	LOS B	10.1	74.5	0.59	0.52	49.9
North: Links Rd											
7	L2	42	2.4	0.200	28.8	LOS C	3.1	22.5	0.81	0.68	36.7
8	T1	60	6.7	0.200	24.2	LOS C	3.1	22.5	0.81	0.68	35.1
9	R2	305	3.9	0.910	56.0	LOS E	15.7	113.6	1.00	1.14	29.3
Approach		407	4.2	0.910	48.5	LOS D	15.7	113.6	0.95	1.02	30.5
West: Christie St											
10	L2	349	4.6	0.249	6.5	LOS A	1.7	12.4	0.24	0.62	49.8
11	T1	969	4.7	0.894	25.1	LOS C	32.4	239.9	0.81	0.86	40.7
12	R2	96	18.8	0.894	41.1	LOS D	32.4	239.9	0.97	1.11	33.2
Approach		1414	5.7	0.894	21.6	LOS C	32.4	239.9	0.68	0.82	42.2
All Vehicles		2774	6.8	0.910	22.3	LOS C	32.4	239.9	0.70	0.75	41.4

D.4.4 2031 PM PEAK WITH REZONING

MOVEMENT SUMMARY

Site: I-22 [I-22ChristieSt-LeeholmRd-LinksRd-2031 PM with rezoning]

Christie St & Leeholm Rd & Link Rd
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Leeholm Rd											
1	L2	109	18.3	0.342	33.6	LOS C	4.3	34.8	0.88	0.76	33.8
2	T1	18	22.2	0.342	28.8	LOS C	4.3	34.8	0.88	0.76	32.6
3	R2	3	0.0	0.009	30.5	LOS C	0.1	0.6	0.80	0.62	32.9
Approach		130	18.5	0.342	32.8	LOS C	4.3	34.8	0.88	0.76	33.6
East: Christie St											
4	L2	1	0.0	0.503	14.3	LOS B	12.8	91.6	0.59	0.53	45.8
5	T1	1332	2.9	0.611	9.3	LOS A	17.2	123.4	0.63	0.56	51.1
6	R2	26	3.8	0.094	24.4	LOS C	0.7	5.0	0.69	0.70	38.0
Approach		1359	2.9	0.611	9.6	LOS A	17.2	123.4	0.63	0.57	50.8
North: Links Rd											
7	L2	7	0.0	0.033	30.7	LOS C	0.4	3.0	0.81	0.62	35.8
8	T1	7	0.0	0.033	26.1	LOS C	0.4	3.0	0.81	0.62	34.2
9	R2	174	13.2	0.745	43.7	LOS D	7.2	56.3	1.00	0.91	32.3
Approach		188	12.2	0.745	42.6	LOS D	7.2	56.3	0.99	0.89	32.5
West: Christie St											
10	L2	421	2.4	0.301	6.4	LOS A	1.9	13.7	0.23	0.62	49.8
11	T1	786	2.5	0.747	13.6	LOS B	16.4	117.2	0.69	0.64	47.5
12	R2	71	2.8	0.747	24.6	LOS C	16.4	117.2	0.85	0.82	40.5
Approach		1278	2.5	0.747	11.9	LOS B	16.4	117.2	0.55	0.64	47.9
All Vehicles		2955	4.0	0.747	13.7	LOS B	17.2	123.4	0.63	0.63	46.7

APPENDIX D

NOISE AND VIBRATION IMPACT ASSESSMENT REPORT

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LINKS ROAD EXTENSION

OPERATIONAL AND CONSTRUCTION NOISE IMPACT ASSESSMENT

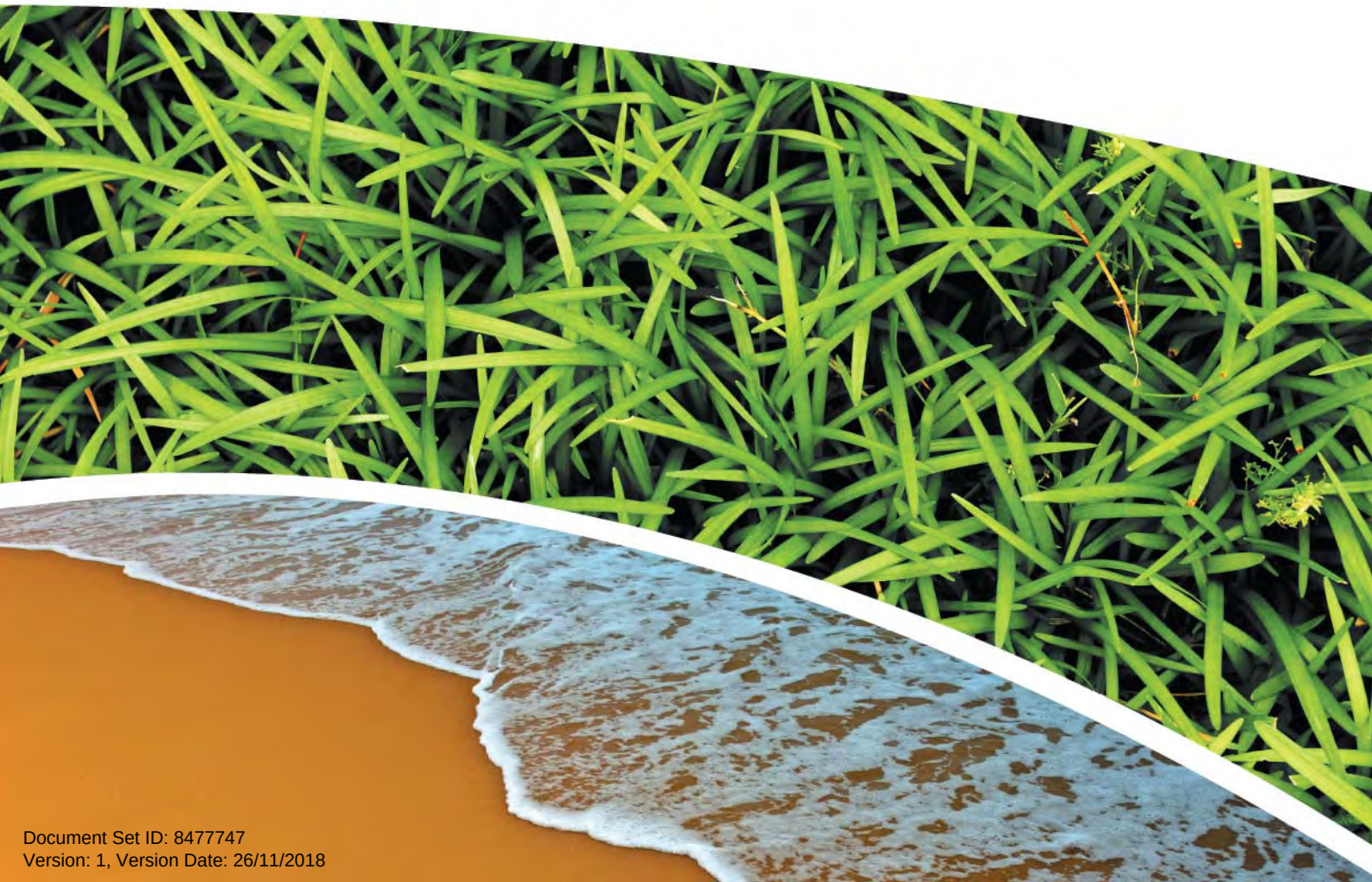
Prepared for WSP

Prepared by RCA Australia

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RCA AUSTRALIA
ABN 53 063 515 711

92 Hill Street, CARRINGTON NSW 2294

Telephone: +61 2 4902 9200
Facsimile: +61 2 4902 9299
Email: administrator@rca.com.au
Internet: www.rca.com.au

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APPENDIX A

Terms and Definitions

APPENDIX B

Operational $L_{Aeq,15\ hr}$ (Day) noise contours, year of opening and 10 year horizon (1.5 m above ground using CORTN)

APPENDIX C

Operational $L_{Aeq,9\ hr}$ (Night) noise contours, year of opening and 10 year horizon (1.5 m above ground using CORTN)

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APPENDIX D

CONSTRUCTION NOISE CONTOURS

APPENDIX E

PROPOSED ROAD ALIGNMENT

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RCA ref 13810-401/2

20 November 2018

WSP Australia Pty Ltd
Level 27, 680 George St
SYDNEY NSW 2000

OPERATIONAL AND CONSTRUCTION NOISE IMPACT ASSESSMENT FOR LINKS ROAD UPGRADE

1 EXECUTIVE SUMMARY

1.1 OPERATIONAL NOISE IMPACT ASSESSMENT

An operational noise impact assessment was undertaken for the proposal. The scope of this assessment included the measurement and documentation of the existing road traffic noise at the proposal location. Noise monitoring and modelling of existing traffic noise indicated that receivers exposed to noise from the proposed redevelopment currently receive low levels of road noise. RCA has determined that the road noise generated by the development will be below the relevant criteria for all receivers, both at the year of opening and with 10 year projected traffic levels.

1.2 CONSTRUCTION NOISE IMPACT ASSESSMENT

11 construction scenarios, representing worst-case noise impacts during day and night periods, were modelled in computer software CadnaA. The majority of modelled construction scenarios are predicted to exceed the relevant criteria at residential NCAs and the nearby golf course. Noise impacts may extend up to 950 m from the construction footprint during the day and 1050 m from the site at night, depending on topography and shielding effects. Mitigation measures to manage these impacts are recommended in **Section 9**.

Robert Carr & Associates Pty Ltd
T/A RCA Acoustics ABN 53 063 515 711
92 Hill St, PO Box 175 Carrington NSW 2294
Ph 02 4902 9200 Fax 02 4902 9299
Email administrator@rca.com.au
Web www.rca.com.au

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2 INTRODUCTION

RCA Acoustics (RCA) has been engaged by WSP (the client) to prepare an Operational and Construction Noise Impact Assessment for the proposed Links Road upgrade in St Marys NSW. This assessment will form part of a Statement of Environmental Effects (SEE) being prepared by the client on behalf of Lendlease Communities to support a development application (DA) to Penrith City Council.

The purpose of the Operational Noise Assessment is to determine the extent of noise impacts generated by the road post-development, as determined by the criteria laid out in the *Road Noise Policy* (RNP) (Department of Environment Climate Change & Water, 2011).

The purpose of the Construction Noise and Vibration Assessment is to assess the potential noise and vibration impacts nearby noise sensitive receivers may experience due to the construction of the proposal. Construction noise impacts are assessed in accordance with the *Interim Construction Noise Guideline* (ICNG) (Department of Environment & Climate Change, 2009). Vibration impacts are assessed against British Standard BS 7385 and *Assessing Vibration: A Technical Guideline* (Department of Environment & Conservation, 2006).

3 PROPOSAL DESCRIPTION

The Penrith City Council propose to upgrade and extend Links Rd in St Marys. The key components of the proposal are:

- Upgrading the existing Links Road from Dunheved Precinct to Dunheved Golf Club.
- Extending Links Rd to Christie St.
- Construction of a new four-way intersection at Christie St and Lee Holm Rd.
- Utility works and drainage upgrades.
- Provision of supporting roadside infrastructure including street lighting and signage.

Construction is anticipated to take approximately 10 months, commencing in 2019 (pending approval).

4 EXISTING ACOUSTIC ENVIRONMENT

Links Rd is currently classed as a local road, and connects an industrial area in St Marys and Dunheved Golf Club to Ropes Crossing Boulevard. The section of road to be upgraded is west of Dunheved Circuit, and runs between the golf club and the western boundary of the industrial area.

Sensitive receivers near the site were grouped into noise catchment areas (NCAs) based on their existing acoustic environment. Approximate NCA boundaries were identified with the assistance of attended monitoring. Existing residential receivers were located nearby to the west and southwest of the site; a new area of housing currently under development to the northwest was also included. Two residential areas were also identified to the east. The area is considered to be suburban.

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Industrial areas to the east and southeast, and two golf clubs to the west and southwest, were also included in the assessment.

The noise catchment areas identified for the purpose of this assessment are shown in **Figure 4-1**.

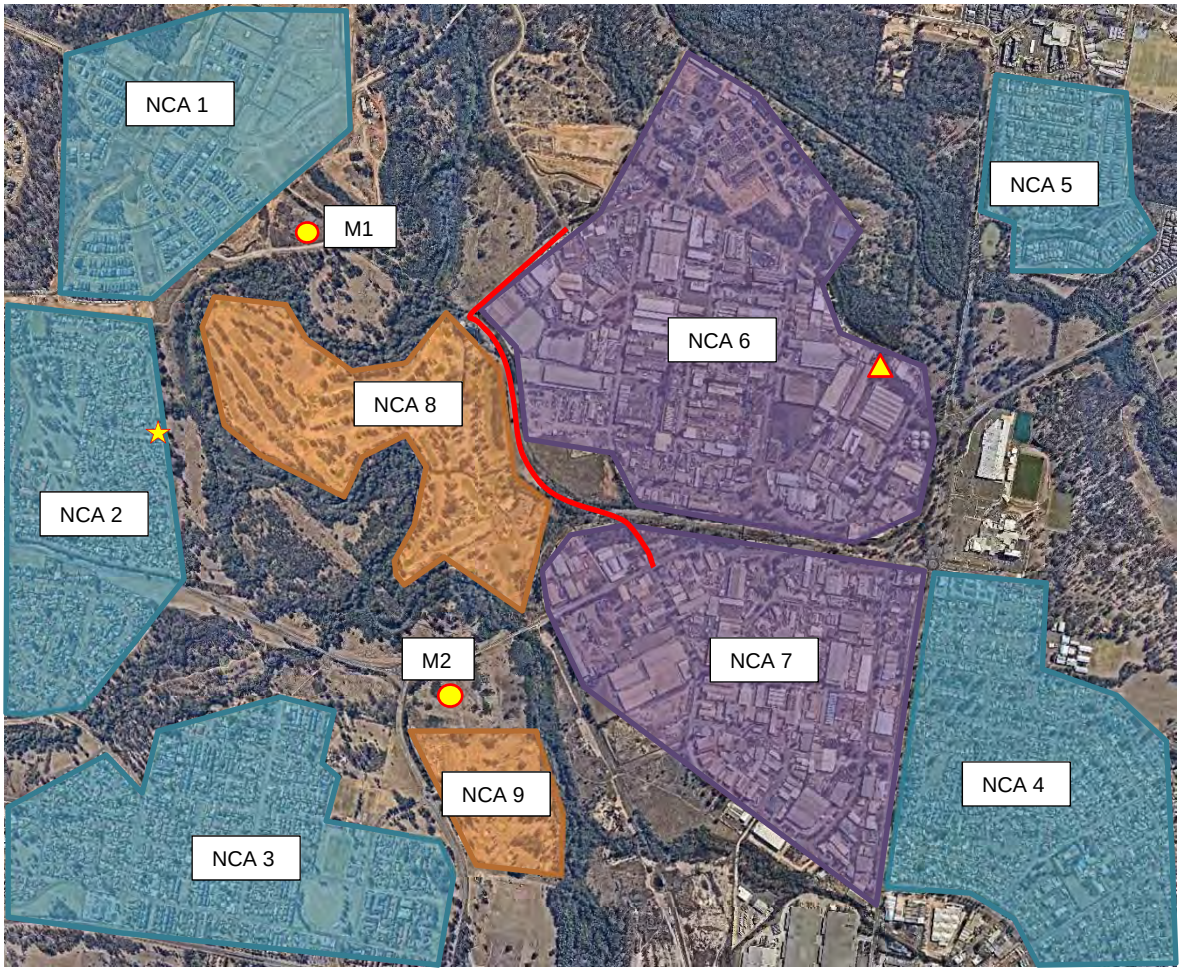


Figure 4-1 *Residential regions ( ), recreation areas ( ) and industrial areas ( ) near proposed development of Links Rd ( ). Also marked are the locations of unattended monitoring ( ), attended monitoring only ( ), and RCA's traffic counting ( ).*

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4.1 TRAFFIC COUNTS

Prior to conducting modelling of the predicted operational road, a model of the existing road was developed in order to validate the parameters used in the model. A traffic count was undertaken for this noise assessment to be used as input into this calibration model. The traffic count was conducted on Links Road on 14 September 2018. The location of the traffic count is shown in **Figure 4-1**. The data is summarised and presented below in **Table 4-1**.

Table 4-1 *Manual traffic count of Links Road, 14 September 2018*

Count period	South bound light vehicles	South bound heavy vehicles	North bound light vehicles	North bound heavy vehicles	Total 1-hour L_{Aeq}
16:44 – 17:44	185	21	60	11	67 dB(A)

4.2 NOISE MONITORING

RCA performed a combination of attended and unattended noise monitoring in order to document the existing ambient acoustic environment. Two unattended noise monitors were deployed: one north of Dunheved Golf Club in a Lend Lease construction site facing Jordan Springs, and one at Colonial Foot Golf Course facing Christie Road.

The attended and unattended noise monitoring locations referred to in this report are shown in **Figure 4-1**.

4.2.1 UNATTENDED NOISE MONITORING

The purpose of unattended noise monitoring is to capture the existing ambient acoustic environment. This data is analysed to provide both road noise metrics ($L_{Aeq,\ 15\ hr}$ and $L_{Aeq,\ 9\ hr}$) and background levels to determine construction noise criteria.

Noise loggers were deployed on 14 September 2018 and were set to continuously record statistical noise data over 15-minute integration periods. Both loggers were retrieved on 25 September 2018. The calibration of the noise loggers was checked before and after the monitoring period and was found to be within 0.5 dB tolerance of 94 dBA. Additional notes regarding each noise logger are provided in **Table 4-2**.

Table 4-2 *Equipment details*

Make/Model	Serial Number	Monitoring reference and location	Settings
SVAN / 971	55580	M1 Lend Lease Construction Site	'A' weighted 'Fast' time response
SVAN / 971	55581	M2 Colonial Foot Golf Course	'A' weighted 'Fast' time response

The rating background levels (RBL) were calculated for each monitoring position in accordance with the Noise Policy for Industry (NPI) (EPA, 2017). A summary of the day / evening / night RBLs and overall L_{eq}'s are provided in **Table 4-3** and **Table 4-4**.

Table 4-3 *M1 unattended noise monitoring summary*

	Day	Evening	Night
RBL	34	32	28
Overall LAeq	45	38	41
Day time LAeq, 15 hr	43	-	-
Night time LAeq, 9 hr	-	-	41

Table 4-4 *M2 unattended noise monitoring summary*

	Day	Evening	Night
RBL	41	43	37
Overall LAeq	50	48	48
Day time LAeq, 15 hr	50	-	-
Night time LAeq, 9 hr	-	-	48

4.2.2 ATTENDED NOISE MONITORING

15-minute attended measurements were conducted at the time of each logger deployment in order to assist in the identification of local noise sources. In addition to this, attended measurements were also taken at other times and positions to better document changes in the ambient acoustic environment across a wider geographical area. Attended monitoring was undertaken either using the logger at the time of deployment or with sound level meter 957 SN28048. All attended measurements were taken using “A-weighting” and “Fast” settings, and calibration was checked and found appropriate before and after measurements. Additional information is provided in **Table 4-5**.

Table 4-5 *15-minute attended measurements*

Date and Time	Location	LAeq	L90	Observations and Instantaneous Sound Pressure Level Ranges
14/9/18 1:36pm	Construction Site alongside Jordan Springs/Links Rd	42	36	Occasional wind gusts: 37 – 42 dBA Frequent loud birds: 50 – 61 dBA Local golfers frequent: 40 – 48 dBA Residential activities occasionally audible: ~42 dBA Jordan Springs traffic is continual: 37 – 43 dBA Local dog barks often: 47 – 51 dBA Construction Site noise occasionally heard 47 – 51 dBA
14/9/18 2:44pm	Colonial Foot Golf Course (on intersection of Christie St and Werrington Rd)	48	43	Christie St traffic is continuous as dominant source: 40 – 59 dBA Werrington Rd traffic is occasional: 44 – 46 dBA Birds intermittent: 43 – 55 dBA Wind is almost constant: 36 – 47 dBA Local dog barking: ~47 dBA Truck reversing on construction site across Christie St: ~48 dBA Two planes flyover: 46 dBA PA from train station across Christie St briefly audible.
14/9/18 3:25pm	23 Hartog Dr, Werrington County NSW 2747	51	37	Occasional plane flyovers: 41 – 54 dBA High amounts of residential traffic: 38 – 64 dBA High amounts of residential noise: 39 – 49 dBA Frequent birds: 44 – 49 dBA Occasional dog barking: 44 – 45 dBA Curious neighbour talking: ~60 dBA Links Rd traffic constant with occasional loud trucks: 38 – 44 dBA
14/9/18 3:40 pm	23 Hartog Dr, Werrington County NSW 2747	47	35	Less frequent plane flyovers: 39 – 52 dBA High amounts of residential traffic: 46 – 66 dBA More frequent amounts of residential noise: 38– 44 dBA Louder birds in background: 55 – 66 dBA More frequent dog barking: 49 – 55 dBA Links Rd traffic constant with occasional loud trucks: 38 – 44 dBA Light wind almost constant: 34 – 37 dBA

14/9/18 3:55 pm	23 Hartog Dr, Werrington County NSW 2747	48	37	Similar amount of plane flyovers: 44 – 60 dBA Similar amount of residential traffic: 44 – 65 dBA Most residential noise from yard work: 37– 44 dBA Less frequent birds: ~54 dBA More constant dog barking: 44 – 50 dBA Curious neighbour talking (residual): ~60 dBA Links Rd traffic constant: ~38 dBA Wind is constant and stronger: 38 – 48 dBA
14/9/18 4:10 pm	23 Hartog Dr, Werrington County NSW 2747	47	38	Similar amount of plane flyovers: 44 – 60 dBA Similar amount of residential traffic: 44 – 65 dBA More frequent residential noise: 39– 42 dBA Birds quieter in general: 45 – 61 dBA Occasional dog barking: ~42 dBA Links Rd traffic constant: 36 – 38 dBA Wind is near constant: 40 – 48 dBA
18/9/18 12:22 pm	23 Hartog Dr, Werrington County NSW 2747	47	32	Frequent dog heard: 40 – 60 dBA Birds: 47 – 57 dBA Residential activities didn't often occur: 35 – 42 dBA Traffic on residential road often: 58 – 72 dBA Links Rd traffic audible, mostly trucks heard: ~36 dBA Construction banging from across golf course: ~50 dBA
18/9/18 12:37 pm	23 Hartog Dr, Werrington County NSW 2747	41	34	Birds: 45 – 65 dBA Residential activities didn't often occur: ~50 dBA Traffic on residential road only heard once: ~40 dBA Links Rd traffic often audible: ~40 dBA Rare wind gusts: ~40 dBA
18/9/18 12:52 pm	23 Hartog Dr, Werrington County NSW 2747	42	34	Birds: 53 – 58 dBA Residential activities often occurred: 37 – 47 dBA Traffic on residential road occurred occasionally: 43 – 54 dBA Plane flyover happened once: 39 – 41 dBA Links Rd traffic often arose, mostly trucks: 38 – 40 dBA Construction banging from across golf course: ~42 dBA

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18/9/18 1:07 pm	23 Hartog Dr, Werrington County NSW 2747	44	34	Birds: 47 – 53 dBA Residential voices and activities audible: 43 - 49 dBA Traffic on residential road occurred occasionally: 44 – 55 dBA Plane flyover happened once: ~41 dBA Wind gust occurred towards end: ~41 dBA Links Rd traffic rarely occurred, mostly trucks: ~39 dBA Construction banging from across golf course: ~42 dBA
25/9/18 12:17 pm	23 Hartog Dr, Werrington County NSW 2747	45	37	Birds frequent in background: 41 – 68 dBA Occasional wind gusts: 36 – 39 dBA Occasional residential activity: 40 – 44 dBA Links Rd constant, occasional engine rev: 37 – 43 dBA Three accounts of residential traffic: 45 – 63 dBA Construction sounds (like a digger/truck reversing) towards northern end of road: 39 – 40 dBA
25/9/18 12:32 pm	23 Hartog Dr, Werrington County NSW 2747	47	36	Birds frequent in background: 46 – 53 dBA Wind gusts are weaker: ~36 dBA Occasional residential activity: 38 – 39 dBA Links Rd constant, occasional engine rev: 37 – 43 dBA More accounts of residential traffic: 40 – 64 dBA One instance of a plane flyover: 40 – 44 dBA One instance of a dog: ~52 dBA Construction sounds towards northern end of road more constant: ~37 dBA Frequent Construction banging from across golf course: 45 – 52 dBA
25/9/18 12:47 pm	23 Hartog Dr, Werrington County NSW 2747	44	37	Birds more frequent: 46 – 58 dBA Rare wind gusts: 36 – 37 dBA Occasional residential activity: 37 – 44 dBA Links Rd constant, occasional engine rev: 38 – 43 dBA Similar amounts of residential traffic: 44 – 63 dBA One instance of a dog: ~52 dBA Construction sounds towards northern end of road frequent: ~38 dBA Frequent Construction banging from across golf course: 45 – 59 dBA

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25/9/18 1:02 pm	23 Hartog Dr, Werrington County NSW 2747	45	36	Birds frequent in background: 46 – 56 dBA Wind gusts stronger: ~38 dBA Occasional residential activity: 38, 50 dBA Links Rd constant with loud trucks: 38 – 42 dBA More accounts of residential traffic: 46 – 67 dBA One instance of a plane flyover: 40 – 44 dBA One instance of a dog: ~42 dBA Construction sounds towards northern end of road more constant: 36 - 48 dBA Frequent Construction banging from across golf course: 43 – 47 dBA

The following conclusions were drawn from conducting attended monitoring:

- The background level (L_{A90}) varies between the NCAs identified for this assessment. Background levels at M1 and Hartog Dr (34-36 dB) were significantly lower than at M2 (43 dB).
- At M1 and M2, background levels were determined by traffic on the road network.
- At Hartog Dr, natural noise sources dominated the ambient acoustic environment (L_{Aeq}), though inspection of the spectral L_{A90} data showed that distant road noise determined the measured background level.

5 ASSESSMENT CRITERIA

5.1 CONSTRUCTION NOISE

Construction noise is assessed in accordance with the ICNG. The ICNG provides advice based on determined Noise Management Levels (NML), which are based on measured background levels.

The ICNG states that a more detailed assessment is required where construction impacts are likely to affect receivers for a period greater than three weeks. The ICNG requires a "quantitative" noise assessment be undertaken for these construction periods, where target noise levels are set and predicted construction noise levels are compared against these target levels. Noise criteria for residential receivers is reproduced in **Table 5-1**.

Table 5-1 *ICNG construction criteria for residential receivers*

Time of day	Management level, $L_{Aeq,15\ min}$, dB	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq,\ 15\ min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

Construction noise criteria has been set for each NCA using the following method:

- As measured daytime background level at M1 was less than 35 dB(A) and measured night time background level was less than 30 dB(A), these have been increased to 35 dB(A) and 30 dB(A) respectively in accordance with the NPI's procedure for determining background levels.
- As the measured evening background level at M2 was higher than the daytime background level, the evening background level has been lowered to match the daytime level, in accordance with Section 2.3 of the NPI. This is due to the greater noise sensitivity of the evening period.
- Measured background levels at M1 have been adopted to represent residents in the Jordan Springs development (NCA 1).
- Measured background levels at M2 have been adopted to represent residents to the southwest of the site (NCA 3).
- L_{A90} measurements taken near NCA 2 were at similar or higher levels than the background levels measured at M1. The noise criteria for NCA 2 are therefore based on the measured levels at M1.
- No measurements were taken near NCA 4. Due to the proximity of the industrial area (NCA 7) and traffic on Forrester Rd, background levels measured at M2 have been adopted for this NCA.
- No measurements were taken near NCA 5. This area is primarily residential and surrounded by bushland, with potential noise from Forrester Rd. Background levels measured at M1 were used for this area due to the similar local noise sources.
- NCA 6 and NCA 7 are industrial areas; the criteria for industrial receivers applies to these NCAs.
- NCA 8 and 9 are golf courses. The NPI defines golf as an active recreation activity, and the appropriate criteria are used for this assessment. Particular attention will be paid to the putting greens (as these are the part of the golf course where noise will be the most disruptive).

Applying the above methodology in conjunction with the ICNG provides the residential criteria for each NCA presented below in **Table 5-2**.

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Table 5-2 *Construction noise criteria for identified residential receivers*

NCA	Noise affected management level, dBA				Highly noise affected management level, dBA
	Recommended standard hours (Day[1])	Outside recommended standard hours (Day[1])	Outside recommended standard hours (Eve[1])	Outside recommended standard hours (Night[1])	Recommended standard hours (Day[1])
NCA 1	45[2]	40[2]	37	35[2]	75
NCA 2	45[2]	40[2]	37	35[2]	75
NCA 3	51	46	46[3]	42	75
NCA 4	51	46	46[3]	42	75
NCA 5	45[2]	40[2]	37	35[2]	75
NCA 6	75	75	75	75	N/A
NCA 7	75	75	75	75	N/A
NCA 8	65	65	65	65	N/A
NCA 9	65	65	65	65	N/A

Note 1: Standard hours (Day) is defined as Monday to Friday 7 am – 6 pm, Saturday 8 am – 1pm, no work on Sundays or public holidays. Outside standard hours (Evening) is defined as 6 pm – 10 pm all days. Night is defined as all other times.

Note 2: In these instances, the effective background level has been increased due to being below the minimum threshold.

Note 3: In these instances, the evening level was reduced to match the daytime level.

5.2 CONSTRUCTION ROAD NOISE

Construction projects have the potential to increase road traffic noise during the construction period due to either an increase in vehicles movements (particularly heavy construction vehicles) along local road networks and/or by diverting local traffic to use a detour. The RNP application notes state that noise increase due to a development should be limited to no more than 2 dB. This will be used as a screening criterion to identify the potential for construction road noise impacts from the proposal.

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5.3 CONSTRUCTION VIBRATION

The *Construction Noise and Vibration Guideline* (CNVG) (RMS, August 2016) provides minimum working distances to avoid cosmetic damage occurring to residential structures (referring to BS 7385) and also to avoid causing human comfort impacts (referring to *Assessing Vibration: A technical Guideline* (DEC, 2006)).

This minimum working distance table is reproduced below in **Table 5-3**.

Table 5-3 *CNVG minimum working distances to avoid vibration impacts*

Plant item	Rating/ Description	Minimum working distance to avoid cosmetic damage	Minimum working distance to avoid human comfort impacts
Vibratory roller	< 50 kN (Typically 1-2 t)	5 m	15 m – 20 m
	< 100 kN (Typically 2-4 t)	6 m	20 m
	< 200 kN (Typically 4-6 t)	12 m	40 m
	< 300 kN (Typically 7-13 t)	15 m	100 m
Small Hydraulic Hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium Hydraulic Hammer	900 kg – 12 to 18 t excavator	7 m	23 m
Large Hydraulic Hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Jackhammer	Hand held	1 m (nominal)	2 m

5.4 OPERATIONAL NOISE

The RNP specifies two types of criteria for road developments: the ‘noise assessment’ criteria, which are general limits, and the ‘relative increase’ criteria, which are intended to avoid a large increase in the level of noise. The relevant criteria for this assessment are detailed in

Table 5-4 below.

During attended monitoring, noise from Dunheved Rd was significant at NCA 3 and noise from local roads was significant at NCA 1. At NCA 2, road noise was not observed to be significant; however, review of the spectral L_{90} data showed that distant traffic dominated the background noise. The measured L_{A90} at each NCA was therefore adopted to represent the existing road noise.

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Table 5-4 *Operational road noise criteria*

Criteria	Day LAeq,15hr – 7am-10pm					Night LAeq,9hr – 10pm-7am				
	NCA 1	NCA 2	NCA 3	NCA 4	NCA 5	NCA 1	NCA 2	NCA 3	NCA 4	NCA 5
Noise assessment criteria for residences – new sub-arterial road	55					50				
Noise assessment criteria for open space, active use	60					N/A				
Existing Traffic Noise	31	31	41	41	31	28	28	37	37	28
Relative increase criteria	43	43	53	53	43	42*	42*	49	49	42*
Noise goals for Links Rd development	43	43	53	53	43	42	42	49	49	42

*Note: Where the existing traffic noise level is below 30 dB(A) L_{Aeq}, it is set to 30 dB(A) for the purposes of the Relative Increase Criteria, in accordance with the RNP.

6 OPERATIONAL NOISE ASSESSMENT

6.1 MODEL VALIDATION

To validate the parameters used in modelling the new road, a model of a section of the existing road was generated. The results of this model can then be compared with levels measured during traffic counting, detailed in **Section 4.2**.

Noise from existing traffic along Links Rd was modelled using computer software CadnaA (version 2017). The CORTN algorithm was implemented, which accounts for road surface, road gradient, traffic volumes, traffic speeds and proportion of heavy vehicles. Roads and Maritime provide guidance on preparing an operational noise model which includes splitting heavy vehicles into different noise source heights when the proportion of heavy vehicles exceeds 10%. Over the period of traffic counting, heavy vehicles formed 12% of passing traffic and so source heights were split.

Model inputs are summarised in **Table 6-1**.

Table 6-1 *Existing road noise model inputs*

Modelling parameter	Setting
Algorithm	CORTN
Ground cover	General setting of G=1 Roads, buildings, and built-up regions set to G=0
Terrain data	3D survey data provided by WSP in DXF for road alignment and surrounding terrain. General terrain outside the alignment is 2 m resolution survey data
Pavement	Dense graded asphalt
Shielding effects	Industrial structures modeled as buildings 5 m high. Residential structures were modelled as buildings 3.5 m high. Areas of buildings in NCA1 and NCA5 were too tightly spaced for individual structures to be entered, so these regions have been modelled as blocks.
Reflections	No reflections were included in the model.
Modelled traffic conditions	Volumes and composition as per **Table 4-1** Speeds set to speed limit of the area – 60 km/h
Aerial imagery	Courtesy of Nearmap (commercial licence)

The results of modelling the existing road are compared with the measured sound levels in **Table 6-2**.

Table 6-2 *Existing road model results*

Measured noise levels $L_{Aeq, 1hr}$	Predicted noise levels $L_{Aeq, 1hr}$	Difference – predicted minus measured
66.5	66.2	-0.3

As the difference between measured and predicted levels is less than 2 dB, the model is considered validated by Roads & Maritime guidelines.

6.2 ASSESSMENT OF NOISE INCREASE DUE TO PROPOSAL

To determine the noise impact of the completed road, the road was constructed in the CadnaA model described in **Section 6.1**. Predicted traffic numbers were supplied by the client for both year of opening (2021) and 10-year forecast (2031) traffic flows. Traffic speeds were set to 50 km/h which will be the posted speed limit for the new section of road.

Noise impacts were predicted at all receivers for the provided traffic numbers.

Table 6-3 summarises the received noise at the worst-affected point in each NCA. (Note that as NCA 6 and NCA 7 consist of industrial land uses, which are not considered sensitive land uses under the RNP, they are not included in this assessment.)

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Table 6-3 *Predicted noise levels at receivers from Links Rd – operational noise*

NCA	Daytime $L_{Aeq,15hr}$			Nighttime $L_{Aeq,9hr}$			Complies with Criteria (2031)?	
	2021	2031	Criteria	2021	2031	Criteria	Day	Night
NCA 1	37	39	43	31	33	42	Yes	Yes
NCA 2	35	37	43	29	31	42	Yes	Yes
NCA 3	32	34	53	26	28	49	Yes	Yes
NCA 4	28	31	53	22	25	49	Yes	Yes
NCA 5	28	30	43	22	24	42	Yes	Yes
NCA 8	53	55	60	47	49	N/A	Yes	Yes
NCA 9	34	36	60	27	30	N/A	Yes	Yes

Noise goals are met at all NCAs for both day and night periods. Operational noise impacts due to the proposal are not anticipated.

7 CONSTRUCTION NOISE ASSESSMENT

7.1 CONSTRUCTION DESCRIPTION

Construction is expected to take approximately10 months to complete, commencing 2019, subject to approvals, weather, land acquisition and coordinating with other activities in St Marys. Most of the work would take place within the standard working hours, between 7 am and 6 pm Monday to Friday and between 8 am and 1 pm on Saturdays.

The proposal is anticipated to involve the following activities:

- Excavation of existing pavement;
- Excavation for stormwater drainage;
- Clearing and excavation of new road corridor
- Utility identification and adjustment where required;
- Laying of new pavement; and
- Furniture installation including traffic lights and line marking.

Some construction activities are likely to be required to be undertaken outside of the standard working hours in order to minimise disruption to peak hour traffic, maintain property access during the day and provide a safe working environment for construction workers.

These activities may include:

- Intersection upgrade works that are considered high risk to be undertaken whilst maintaining the operation of existing traffic lanes; and
- Utility identification and re-adjustment.

7.2 CONSTRUCTION NOISE MODELLING

Construction noise levels have been modelled in CadnaA (version 2017) by representing the construction plant as point sources and calculating the noise propagation according to the ISO 9613 algorithm. This algorithm assumes noise enhancing meteorological conditions and is therefore considered to be conservative.

For the purposes of noise modelling, the client has provided a series of construction activities that are expected to take place over the course of the works:

- Activity 1: Preparation and Enabling
- Activity 2: Utilities
- Activity 3: Surface preparation
- Activity 4: Earthworks
- Activity 5: Drainage
- Activity 6: Road surface
- Activity 7: Tie-in and road markings
- Activity 8: Finishing works
- Activity 9: General compound operation

RCA have identified plant likely to be used in these activities based on the client's comments and the construction scenarios identified in the CNVG. Plant combinations were chosen to represent typical-worst case 15-minute operation for each activity; it is unlikely that all plant will be operating over the full 15 minutes and so this is considered a conservative assessment method. The activities and plant involved are listed in **Table 7-1**. All sound power levels are taken from the CNVG.

Table 7-1 *Construction source sound power levels*

Plant Item	Adopted Sound Power L_{wA}, dB	No. plant involved in Activity no.								
		1	2	3	4	5	6	7	8	9
Asphalt paver	114	0	0	0	0	0	1	0	0	0
Asphalt sprayer	106	0	0	0	0	0	1	0	0	0
Backhoe	111	1	1	0	0	0	0	0	0	0
Car	88	0	0	0	0	0	0	0	0	3
Chainsaw	114	0	0	2	0	0	0	0	0	0
Compactor	106	0	0	0	1	0	1	0	0	0
Compressor	109	0	0	0	0	0	1	0	0	1
Concrete pump	109	0	0	0	0	1	1	0	0	0
Concrete saw	118	0	1	0	0	0	1	0	0	0
Concrete truck	102	0	0	0	0	1	1	0	0	0
Crane	98	1	0	1	0	1	0	0	1	0
Dozer	116	0	0	1	0	1	0	0	0	0
Dump truck	110	0	0	0	2	0	1	0	0	0

Plant Item	Adopted Sound Power L_{wA}, dB	No. plant involved in Activity no.								
		1	2	3	4	5	6	7	8	9
Excavator	110	1	0	1	1	1	0	0	0	0
FEL	112	0	0	0	1	0	0	0	0	0
FEL (small)	91	0	0	0	0	0	0	0	0	1
Generator	103	1	1	0	0	0	1	1	1	1
Grader	113	1	0	0	1	1	0	0	0	0
Hand tools (welding)	105	0	0	0	0	0	0	0	0	1
Line marker	108	0	0	0	0	0	0	1	0	0
Mulcher	116	0	0	1	0	0	0	0	0	0
Padfoot roller	109	0	0	1	0	0	0	0	0	0
Profiler/Milling machine	117	0	0	0	1	0	1	0	0	0
Rock breaker	122	0	0	0	1	0	0	0	0	0
Scissor lift	98	0	1	0	0	0	0	0	0	0
Smooth roller	107	0	0	0	0	0	0	0	0	0
Truck	108	1	1	1	0	0	0	1	1	1
Vib roller	109	0	0	0	0	0	1	0	0	0
Watercart	107	1	1	0	0	0	0	0	0	0

It is expected that most work would be undertaken during standard hours. Work that may be likely to be conducted at night would include Activity 2 (as needed) and all work at the intersection of Christie St and Lee Holm Rd.

As the site is large, multiple scenarios may occur simultaneously, and at different locations. Modelling every possible combination of activity and location is beyond the scope of this assessment. Instead, a worst-case scenario was constructed, to determine the maximum impacts that may occur.

Multiple modelling scenarios were run in order to determine the combination of construction activity and construction location that generated the greatest noise impacts, both in terms of absolute noise levels and greatest number of impacted receivers. These worst case scenarios have been included in this assessment, and include Activities 2, 3, 4, 5, 6, 7, and 9 concentrated on the areas of site that produce the greatest noise impacts. Worst impacted locations (a residence in NCA 1 and golf green in NCA 8) are marked in **Figure 7-1**. As these scenarios represent the maximum extent of noise impacts no other daytime scenarios have been considered.



Figure 7-1 *Worst affected residence (☆) and golf green (☆) during construction, and the areas of site where construction activities occur to generate worst case impacts (— - residence, — - golf green)*

Scenarios considered for the assessment were:

Day Scenarios

- Scenario 1: Worst-case scenario for residential receivers, described above, including Activities 2, 3, 4, 5, 6, 7, and 9.
- Scenario 2: Worst-case scenario for golf course, described above, including Activities 2, 3, 4, 5, 6, 7, and 9.
- Scenario 3: Activity 1 site set-up, including compound operation.

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- Scenario 4: Activity 8 completion of work, including compound operation.

Night Scenarios

- Scenario 5: Activity 2, positioned for worst-case effects on residential receivers to the northwest, including compound operation.
- Scenario 6: Activity 2 at Christie St intersection, positioned for worst case effects on residential receivers to the east and west.
- Scenario 7: Activity 3 at Christie St intersection, positioned for worst case effects on residential receivers to the east and west.
- Scenario 8: Activity 4 at Christie St intersection, positioned for worst case effects on residential receivers to the east and west.
- Scenario 9: Activity 5 at Christie St intersection, positioned for worst case effects on residential receivers to the east and west.
- Scenario 10: Activity 6 at Christie St intersection, positioned for worst case effects on residential receivers to the east and west.
- Scenario 11: Activity 7 at Christie St intersection, positioned for worst case effects on residential receivers to the east and west.

7.3 CONSTRUCTION NOISE RESULTS

Due to the large number of residences affected by construction noise, individual receivers that may be noise affected (i.e. experience levels exceeding the 'noise affected' criteria laid out in **Table 5-2**) have not been identified in this report. Instead, contour maps are presented in **Appendix F** to show the extent of noise impacts in each construction scenario.

Predicted levels at the worst affected receivers in each NCA are presented in **Table 7-2**.

Table 7-2 *Construction noise levels at each NCA*

NCA	Standard Hours Criteria	Night Criteria	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9	Scenario 10	Scenario 11
NCA 1	45	35	53	50	43	39	45	28	30	33	28	32	20
NCA 2	45	35	47	47	36	32	38	34	36	39	34	38	26
NCA 3	51	42	43	45	29	25	34	34	36	41	34	37	26
NCA 4	51	42	37	38	26	21	28	40	43	45	40	43	33
NCA 5	45	35	39	37	29	24	30	32	34	37	31	35	24
NCA 6	75	N/A	82	82	75	70	70	45	47	50	47	50	38
NCA 7	75	N/A	46	53	34	32	37	84	87	91	86	88	76
NCA 8	65	N/A	69	79	51	49	58	41	43	46	41	44	33
NCA 9	65	N/A	40	43	29	25	31	39	41	44	39	42	30

Comments on the status of relevant NCAs is presented in **Table 7-3** below.

Table 7-3 *Predicted noise impacts for construction scenarios*

NCA	Comments
NCA 1	*Scenario 1:* Blocks of houses along the southeastern edge (regions with line of sight to the site) are noise affected. Predicted exceedances range from 1-8 dB, with worst affected receivers those in the east corner, near the receiver marked in **Figure 7-1**. *Scenario 2:* Blocks of houses along the southeastern edge (regions with line of sight to the site) are noise affected. Predicted exceedances range from 1-5 dB, with worst affected receivers those in the east corner, near the receiver marked in **Figure 7-1**. *Scenario 3:* No receivers are noise affected. *Scenario 4:* No receivers are noise affected. *Scenario 5:* Much of the area is noise affected, with exceedances occurring beyond the first blocks of houses along the southeastern edge. Blocks in the eastern corner are worst affected, with exceedances of up to 10 dB. Further to the southwest, or northwest of the blocks on the boundary, exceedances are smaller. *Scenario 6:* No receivers are noise affected. *Scenario 7:* No receivers are noise affected. *Scenario 8:* No receivers are noise affected. *Scenario 9:* No receivers are noise affected. *Scenario 10:* No receivers are noise affected. *Scenario 11:* No receivers are noise affected.
NCA 2	*Scenario 1:* Houses along the eastern edge, including houses on Hartog Dr, Poole St, Wilde Pl, and Meehan Ave, are noise affected. Exceedances are generally small – ~2 dB along Hartog Dr and ~1 dB along Poole St. *Scenario 2:* Houses along the eastern edge including houses on Hartog Dr, Poole St, Wilde Pl, and Meehan Ave are noise affected. Exceedances are generally small – ~2 dB along Hartog Dr and Poole St. *Scenario 3:* No receivers are noise affected. *Scenario 4:* No receivers are noise affected. *Scenario 5:* Houses along the eastern edge, including houses on Hartog Dr, Poole St, Wilde Pl, and Meehan Ave, are noise affected. Exceedances along Hartog Dr are around ~3 dB and along Poole St generally ~2 dB. *Scenario 6:* No receivers are noise affected. *Scenario 7:* Houses along the eastern edge, including houses on Poole St and Lockyer Ave, are noise affected. Exceedances are generally marginal, 1 dB or less. *Scenario 8:* Houses along the eastern edge, including houses on Hartog Dr, Poole St, Meehan Ave, Wilde Pl, Thomas Bell Ave, and Lockyer Ave, are noise affected. Exceedances range from 1-2 dB along Hartog Dr and 2-4 dB along Poole St. *Scenario 9:* No receivers are noise affected. *Scenario 10:* Houses along the eastern edge are noise affected, including residences on Hartog Dr, Wilde Pl, Poole St, and Lockyer Ave. Exceedances are generally small (1-2) dB along Hartog Dr and 2-3 dB elsewhere. *Scenario 11:* No receivers are noise affected.

NCA 3	*Scenario 1:* No receivers are noise affected. *Scenario 2:* No receivers are noise affected. *Scenario 3:* No receivers are noise affected. *Scenario 4:* No receivers are noise affected. *Scenario 5:* No receivers are noise affected. *Scenario 6:* No receivers are noise affected. *Scenario 7:* No receivers are noise affected. *Scenario 8:* No receivers are noise affected. *Scenario 9:* No receivers are noise affected. *Scenario 10:* No receivers are noise affected. *Scenario 11:* No receivers are noise affected.
NCA 4	*Scenario 1:* No receivers are noise affected. *Scenario 2:* No receivers are noise affected. *Scenario 3:* No receivers are noise affected. *Scenario 4:* No receivers are noise affected. *Scenario 5:* No receivers are noise affected. *Scenario 6:* No receivers are noise affected. *Scenario 7:* Houses in the northwestern corner are noise affected, including houses on Forrester Rd, Maple Rd, Hinton Glen, and the western façade of Boronia House. Exceedances are generally marginal - 1 dB or less. *Scenario 8:* Houses in the northwestern corner are noise affected, including houses along Forrester Rd, Hinton Glen, Maple Rd, Aylett St, and Liddle St, and the western façade of Boronia House. Exceedances range from 2-3 dB along Forrester St and at Boronia House, and are small (1-2 dB) elsewhere. *Scenario 9:* No receivers are noise affected. *Scenario 10:* Houses in the northwestern corner are noise affected, including houses along Forrester Rd, Maple St, Hinton Glen, Commonwealth Cres and the western façade of Boronia House. Exceedances are generally marginal, 1 dB or less. *Scenario 11:* No receivers are noise affected.
NCA 5	*Scenario 1:* No receivers are noise affected. *Scenario 2:* No receivers are noise affected. *Scenario 3:* No receivers are noise affected. *Scenario 4:* No receivers are noise affected. *Scenario 5:* No receivers are noise affected. *Scenario 6:* No receivers are noise affected. *Scenario 7:* No receivers are noise affected. *Scenario 8:* Houses in the southwestern region are noise affected, including houses on Townsend Cres, Susannah Dr, and Ferdinand Cres. Exceedances are generally small, ~2 dB along Townsend Cres and 1 dB or less elsewhere. *Scenario 9:* No receivers are noise affected. *Scenario 10:* Houses on the southwestern edge, on Townsend Cres, are noise affected. Exceedances are generally marginal - 1 dB or less. *Scenario 11:* No receivers are noise affected.

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NCA 6	*Scenario 1:* Receivers immediately adjacent to the construction works (along Links Rd) are noise affected. *Scenario 2:* Receivers immediately adjacent to the construction works (along Links Rd) are noise affected. *Scenario 3:* No receivers are noise affected. *Scenario 4:* No receivers are noise affected.
NCA 7	*Scenario 1:* Receivers immediately adjacent to the construction works (along Links Rd) are noise affected. *Scenario 2:* Receivers immediately adjacent to the construction works (along Links Rd) are noise affected. *Scenario 3:* No receivers are noise affected. *Scenario 4:* No receivers are noise affected.
NCA 8	*Scenario 1:* Five golf greens will be noise affected (those in the northeast corner of the course). Exceedances range from 1-4 dB. *Scenario 2:* Seven golf greens will be noise affected (those in the northeastern region of the course). Exceedances range from 1-14 dB. *Scenario 3:* No regions of the golf course are noise affected. *Scenario 4:* No regions of the golf course are noise affected.
NCA 9	*Scenario 1:* No regions of the golf course are noise affected. *Scenario 2:* No regions of the golf course are noise affected. *Scenario 3:* No regions of the golf course are noise affected. *Scenario 4:* No regions of the golf course are noise affected.

In the majority of construction scenarios, the noise criteria are exceeded for some of the identified receivers. Mitigation options therefore need to be considered in order to limit noise impacts for identified receivers.

In general, NCA 1 is the worst affected residential NCA during daytime works, although NCA 2 may experience higher noise levels than NCA 1 depending on the location of works to be carried out. This is due to the close proximity of both NCAs to the site, the lack of screening structures to mitigate sound, and the low background noise levels in both areas. NCA 8 is also affected by noise works across the full length of the site. The maximum exceedance at a residence was 8 dB (NCA 1 Scenario 1); at the golf course (NCA 8) the maximum exceedance was 14 dB (Scenario 2).

For night works, NCA 1 or NCA 2 may be the worst affected NCA for utilities work, depending on the location of the works along the new Links Rd alignment. For works at the Christie St intersection, NCA 2 and NCA 4 are the worst affected NCAs. For NCA 4, this is due to the proximity of the works to the closest residences; for NCA 2, the impacts are largely due to the low background noise in the area. The maximum exceedance was 10 dB (NCA 1, Scenario 5).

Daytime scenarios with the maximum activities occurring (Scenarios 1 and 2) generated the most noise. The noisiest individual activities were earthworks and surface preparation, followed by drainage and road surfacing; the noisiest night scenario was earthworks occurring at the Christie St intersection.

8 CONSTRUCTION VIBRATION ASSESSMENT

The closest residential receiver is approximately 680 m from the construction site. The CNVG lays out recommended working distances from residential buildings to minimize the risk of cosmetic damage, as well as preferred working distances for human comfort. The maximum distance at which vibration impacts may occur is 100 m (human comfort impacts due to vibratory rollers). As the closest residential receiver is much further from the site than this – approximately 680 m away – no vibration impacts are expected for the project.

9 MITIGATION MEASURES

The ICNG gives guidelines on selecting reasonable and feasible noise mitigation. RCA have reviewed Section 6 of the ICNG and the following mitigation measures are recommended in order to minimize noise impacts:

- Work should be conducted inside standard hours (7am-6pm Mon-Fri, 8am-1pm Sat) where practicable.
- At night, work involving the following plant should be concluded prior to 11pm where practicable:
    - Concrete saw
    - Dozer
    - Mulcher
    - Profiler
    - Rock breaker
- Design the compound layout so that the use of reversing alarms is minimized.
- Avoid dropping materials from a height.
- Turn off plant items and vehicles when not in use.
- Ensure that residents in NCAs that will be affected by noise (NCAs 1, 2, 4, and 5) are informed of the project scope and duration of noisy works. Notification should also be provided for out-of-hours noise impacts.

10 CONCLUSION

RCA was engaged by WSP to prepare a construction and operational noise and vibration impact assessment for the extension and upgrade of Links Rd, St Marys. This report will form part of a Statement of Environmental Effects as part of a development application for submission to Penrith City Council.

This assessment found that operational noise does not exceed criteria from the Road Noise Policy at any NCA.

Construction noise impacts may extend up to 1050 m away from the construction footprint at night time, depending on topography and shielding effects. It is recommended that mitigation measures be applied during construction to minimize the noise impact.

Yours faithfully
RCA ACOUSTICS & VIBRATION



Natasha Pegler
Acoustic Consultant

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Appendix A

Terms and Definitions

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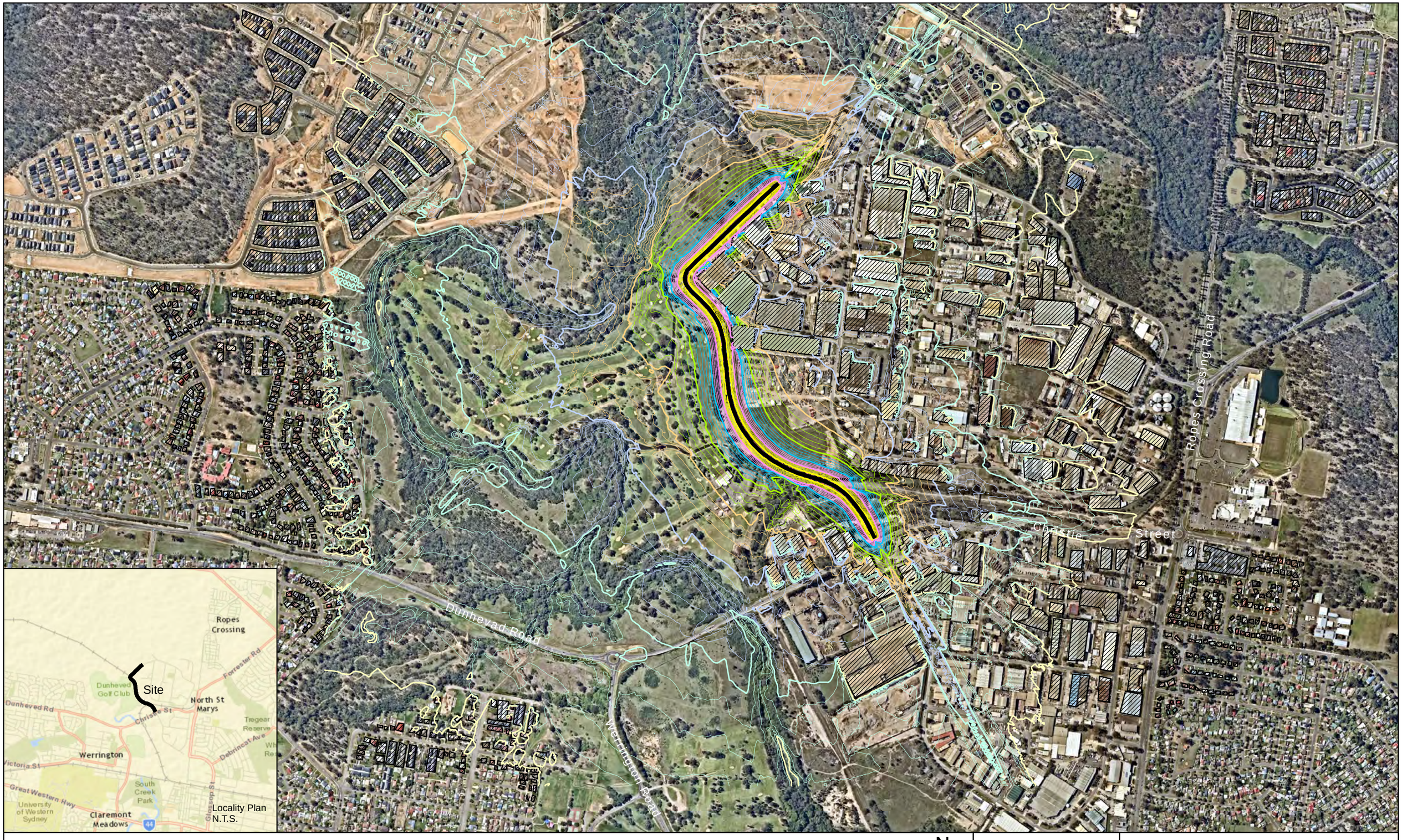
Terms and Definitions

dB(A)	Unit of sound pressure level, modified by the A-weighting network to represent the sensitivity of the human ear.
SPL	The incremental variation of sound pressure from the reference pressure level expressed in decibels.
SWL (L_W)	Sound Power Level of a noise sources per unit time expressed in decibels from reference level $W_{O.}$
L_X	Statistical noise descriptor. Where (x) represents the percentage of the time for which the specified noise level is exceeded.
L_{eq}	Equivalent continuous noise level averaged over time on an equivalent energy basis.
$L_{Aeq,\ 15\ hr}$	Equivalent continuous noise level averaged over 15 hours between 7 am and 10 pm.
$L_{Aeq,\ 9\ hr}$	Equivalent continuous noise level averaged over 9 hours between 10 pm and 7 am.
L_{90}	The 10^{th} percentile noise level recorded over a measurement period. Also described as the average Minimum Noise Level in a measurement period.
L_{max}	Maximum Noise Level in a measurement period.
Background Noise Level	Noise level determined for planning purposes as the one tenth percentile of the ambient L_{A90} noise levels.
PO	Reference Sound Pressure for the calculation of SPL in decibels.
WO	Reference Sound Power for the calculation of SWL in decibels.

Appendix B

Operational LAeq,15 hr (Day) noise contours, year of opening and 10 year horizon (1.5 m above ground using CORTN)

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LEGEND

Modelled Buildings

Road - Operational

L_{Aeq} Noise Contours, dB

30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-68

Note:
Aerial image taken from Nearmap, October 3 2018
(used in accordance with commercial licence)

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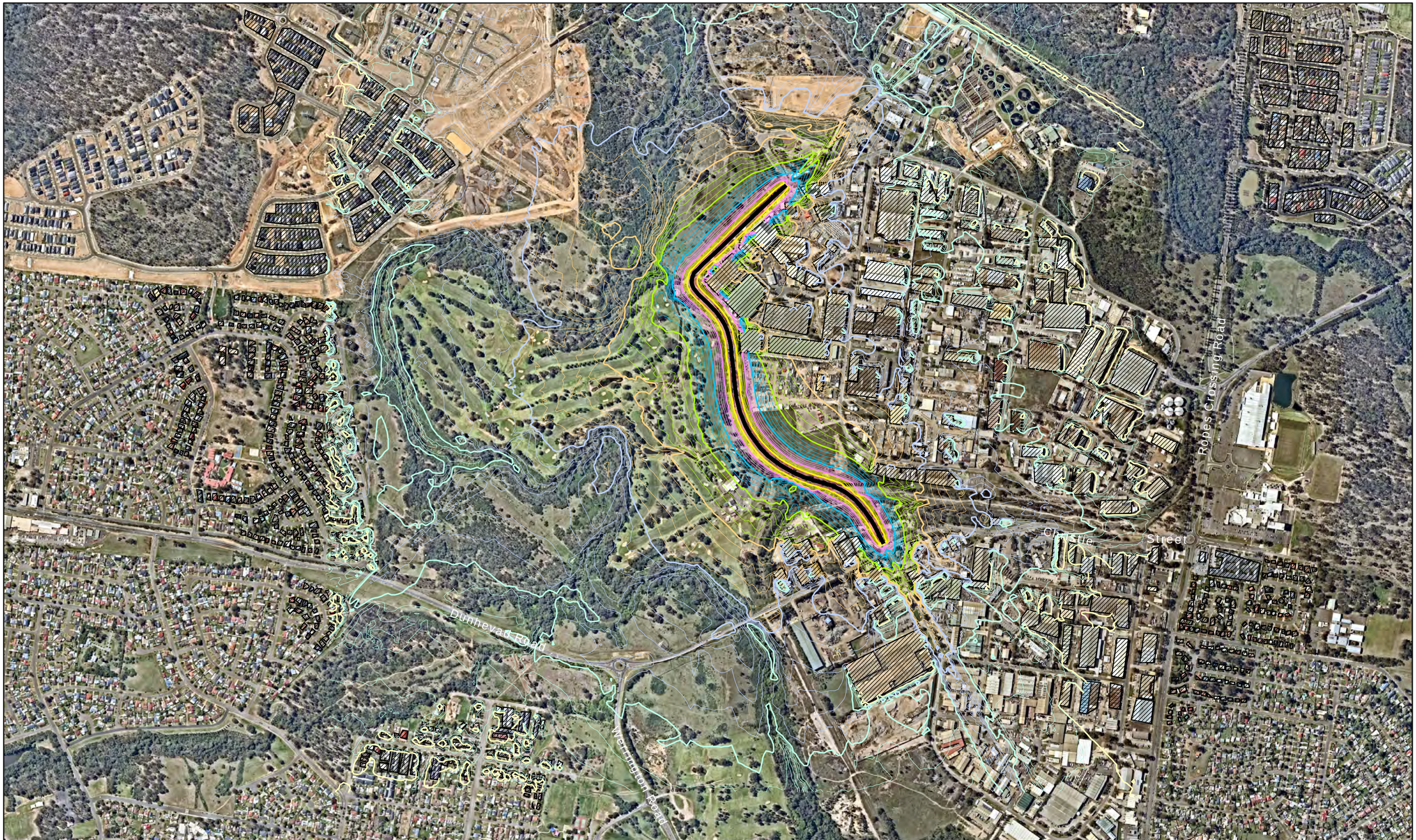
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metres

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

OPERATIONAL NOISE 2021 DAY
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0
DRAWN BY	NP	SCALE	1:10,000 (A3)	DRAWING 1	REV 0
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LEGEND

Modelled Buildings

Road - Operational

L_{Aeq} Noise Contours, dB

30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70

Note:
Aerial image taken from Nearmap, October 3 2018
(used in accordance with commercial licence)

N

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metres

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

OPERATIONAL NOISE 2031 DAY
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

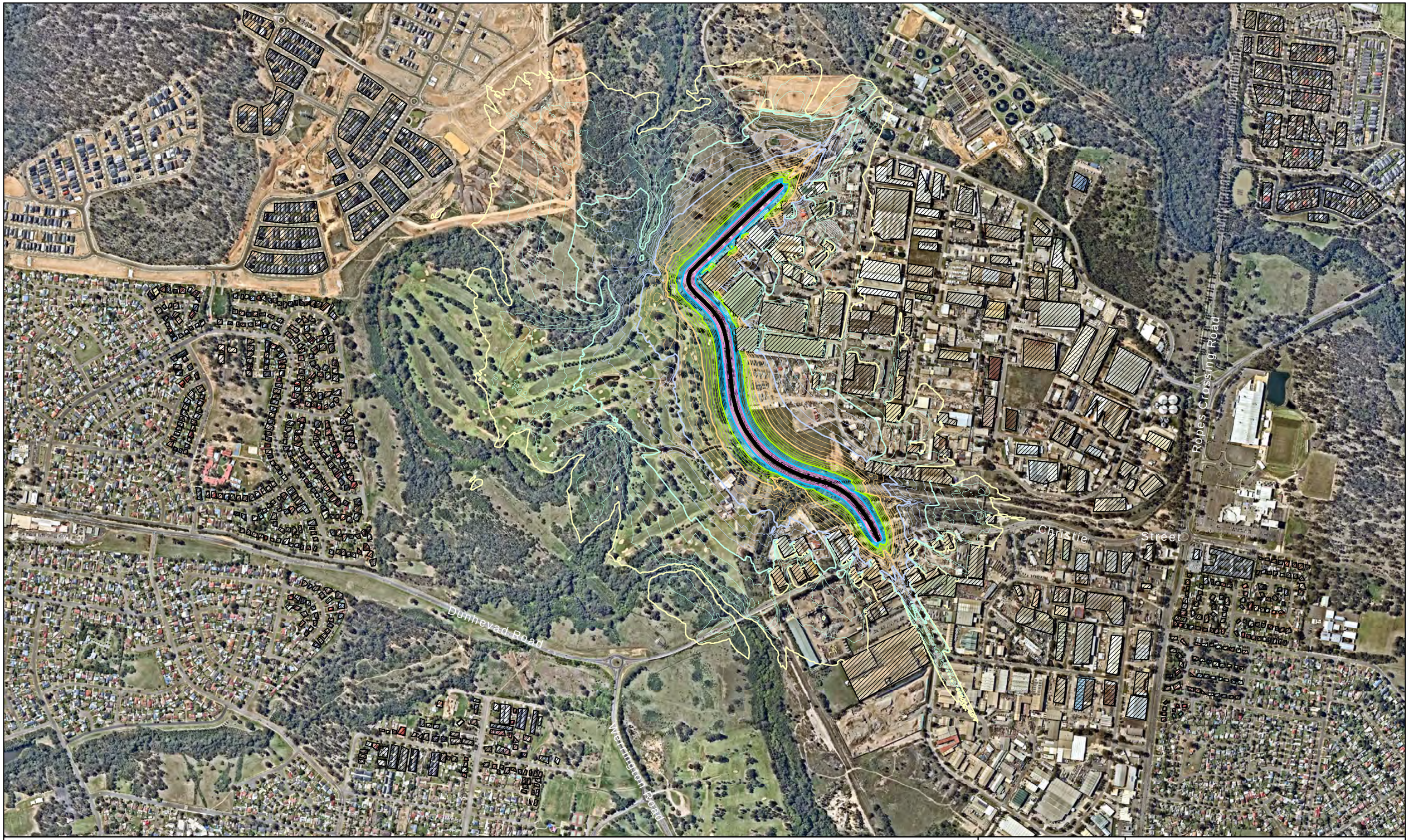
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APPROVED BY	AR	DATE	6/11/2018	OFFICE	NEWCASTLE

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Appendix C

Operational LAeq,9 hr (Night) noise contours, year of opening and 10 year horizon (1.5 m above ground using CORTN)

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Version: 1, Version Date: 26/11/2018



LEGEND

Modelled Buildings

Road - Operational

L_{Aeq} Noise Contours, dB

30
31-35
36-40
41-45
46-50
51-55
56-60
61

Note:
Aerial image taken from Nearmap, October 3 2018
(used in accordance with commercial licence)

N

0 100 200 400 600 800
metres

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

OPERATIONAL NOISE 2021 NIGHT
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0
DRAWN BY	NP	SCALE	1:10,000 (A3)	DRAWING 3	REV 0
APPROVED BY	AR	DATE	6/11/2018	OFFICE	NEWCASTLE

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Dunnevad Road

Wernington Road

Ropes Crossing Road

Christie Street

LEGEND

Modelled Buildings

Road - Operational

L_{Aeq} Noise Contours, dB

30
31-35
36-40
41-45
46-50
51-55
56-60
61-65

Note:
Aerial image taken from Nearmap, October 3 2018
(used in accordance with commercial licence)

N

0 100 200 400 600 800
metres

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

OPERATIONAL NOISE 2031 NIGHT
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

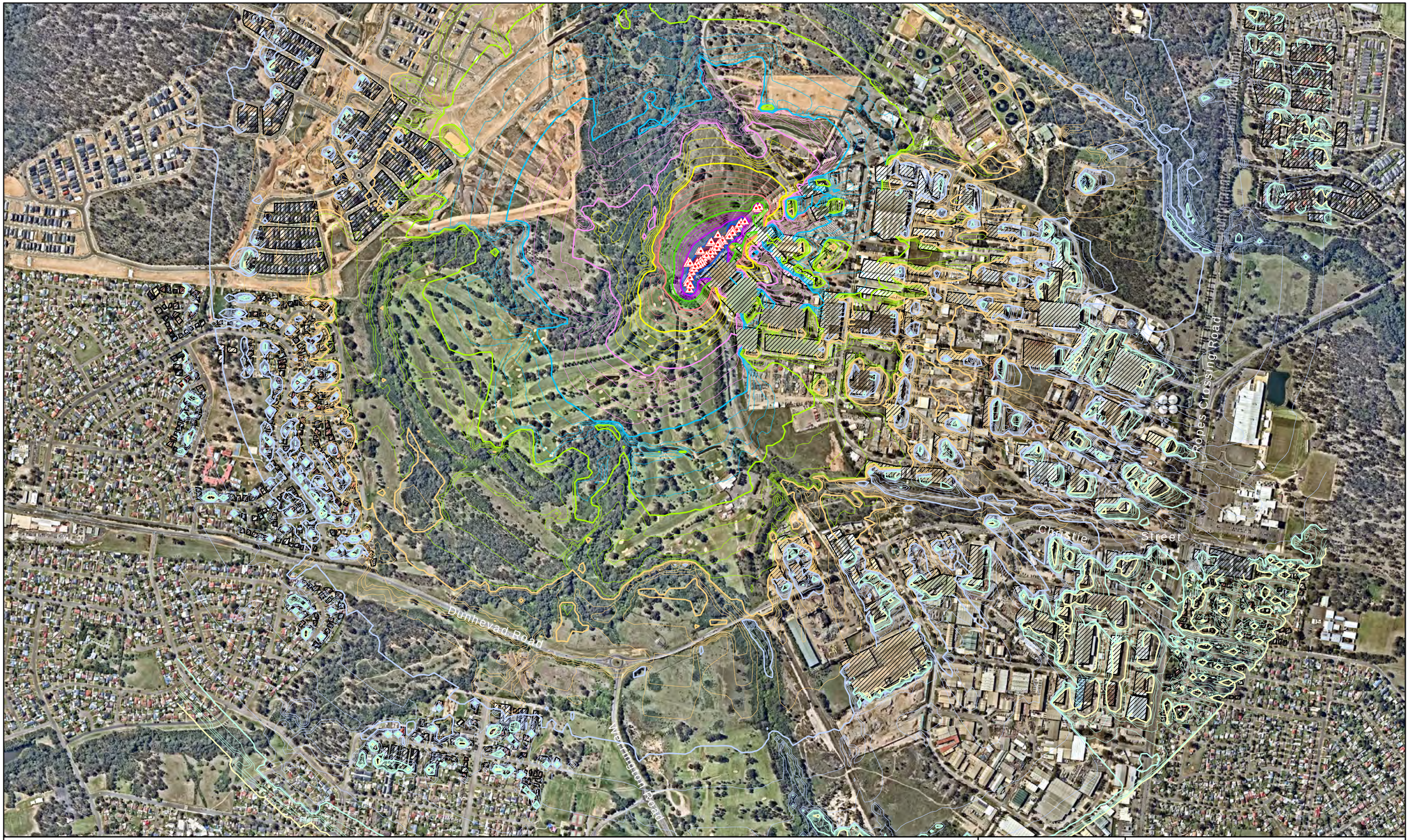
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Appendix D

Construction noise contours

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LEGEND

Modelled Buildings

Construction plant

L_{Aeq} Noise Contours, dB

30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-98

Note:
Aerial image taken from Nearmap, October 3 2018
(used in accordance with commercial licence)

N

0 100 200 400 600 800
metres

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

CONSTRUCTION SCENARIO 1
WORST CASE FOR RESIDENCES
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0
DRAWN BY	NP	SCALE	1:10,000 (A3)	DRAWING 5	REV 0
APPROVED BY	AR	DATE	6/11/2018	OFFICE	NEWCASTLE

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Dunheved Road

Werrington Road

Christie Street

Lopes Crossing Road

LEGEND

Modelled Buildings

Construction plant

L_{Aeq} Noise Contours, dB

30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-98

Note:
Aerial image taken from Nearmap, October 3 2018
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N

0 100 200 400 600 800
metres

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

CONSTRUCTION SCENARIO 2
WORST CASE FOR GOLF COURSE LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0
DRAWN BY	NP	SCALE	1:10,000 (A3)	DRAWING 6	REV 0
APPROVED BY	AR	DATE	6/11/2018	OFFICE	NEWCASTLE

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LEGEND

Modelled Buildings

Construction plant

L_{Aeq} Noise Contours, dB

30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	
46-50	71-75	

Note:
Aerial image taken from Nearmap, October 3 2018
(used in accordance with commercial licence)

N

0 100 200 400 600 800
metres

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

CONSTRUCTION SCENARIO 3
SITE ESTABLISHMENT
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0
DRAWN BY	NP	SCALE	1:10,000 (A3)	DRAWING 7	REV 0
APPROVED BY	AR	DATE	6/11/2018	OFFICE	NEWCASTLE

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Version: 1, Version Date: 26/11/2018

Dunnevad Road

Wernington Road

Ropes Crossing Road

Christie Street

LEGEND

Modelled Buildings

Construction plant

L_{Aeq} Noise Contours, dB

30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-88
41-45	66-70	
46-50	71-75	

Note:
Aerial image taken from Nearmap, October 3 2018
(used in accordance with commercial licence)

N

0 100 200 400 600 800
metres

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

CONSTRUCTION SCENARIO 4
FINISHING
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0
DRAWN BY	NP	SCALE	1:10,000 (A3)	DRAWING 8	REV 0
APPROVED BY	AR	DATE	6/11/2018	OFFICE	NEWCASTLE

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Dunheved Road

Werrington Road

Christie Street

Ropes Crossing Road

LEGEND

Modelled Buildings

Construction plant

L_{Aeq} Noise Contours, dB

30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
76-80
81-85
86-89

Note:
Aerial image taken from Nearmap, October 3 2018
(used in accordance with commercial licence)

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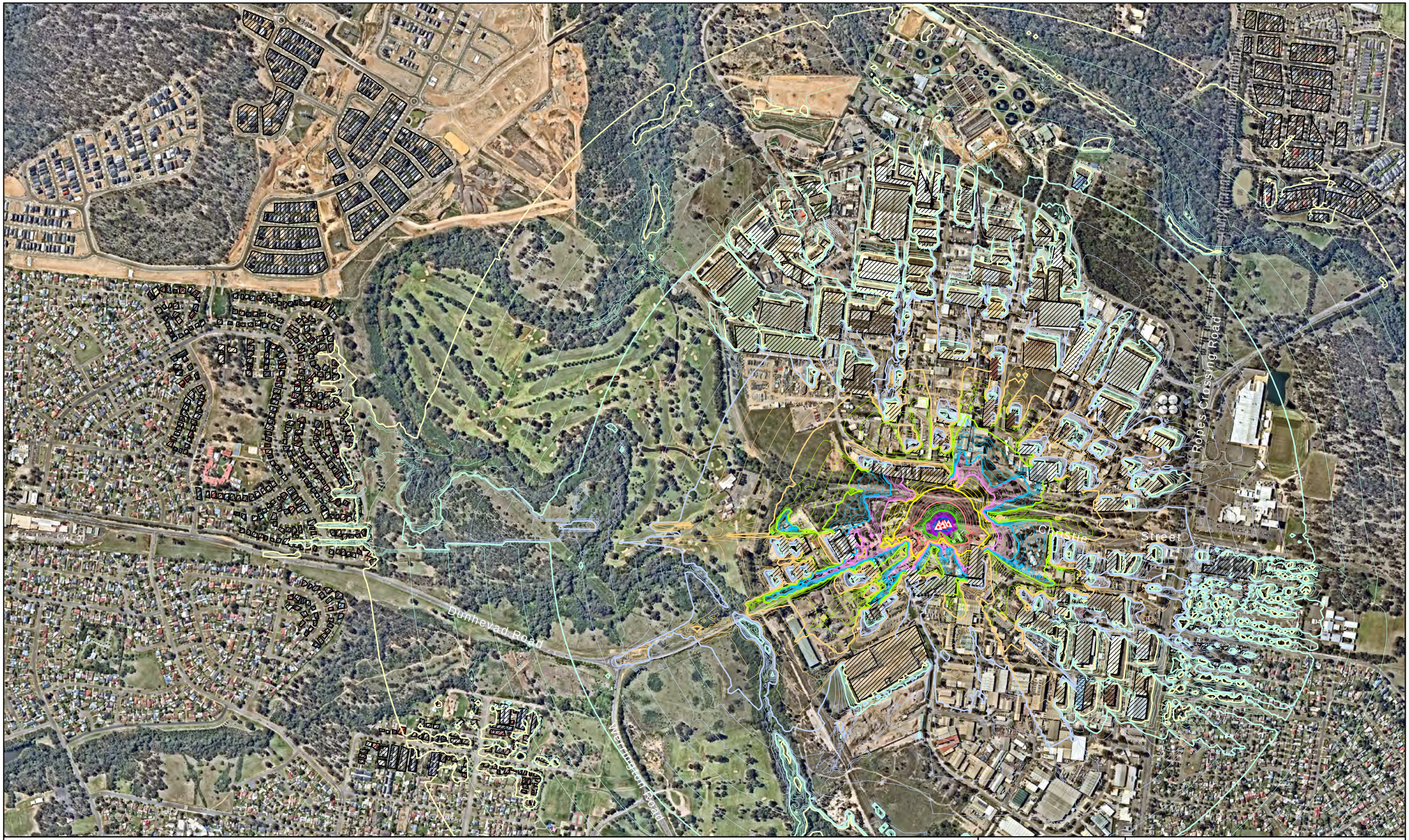
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RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

CONSTRUCTION SCENARIO 5
NIGHT UTILITIES WORKS NORTH
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0	
DRAWN BY	NP	SCALE	1:10,000 (A3)	DRAWING	9	REV 0
APPROVED BY	AR	DATE	6/11/2018	OFFICE	NEWCASTLE	

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Version: 1, Version Date: 26/11/2018



LEGEND

Modelled Buildings

Construction plant

L_{Aeq} Noise Contours, dB

30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-98

Note:
Aerial image taken from Nearmap, October 3 2018
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N

0 100 200 400 600 800
metres

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

CONSTRUCTION SCENARIO 6
NIGHT UTILITIES WORKS
CHRISTIE STREET INTERSECTION
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0
DRAWN BY	NP	SCALE	1:10,000 (A3)	DRAWING 10	REV 0
APPROVED BY	AR	DATE	6/11/2018	OFFICE	NEWCASTLE

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Dunnevad Road

Wellington Road

Christie Street

Rones Crossing Road

LEGEND

Modelled Buildings

Construction plant

L_{Aeq} Noise Contours, dB

30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-100

Note:
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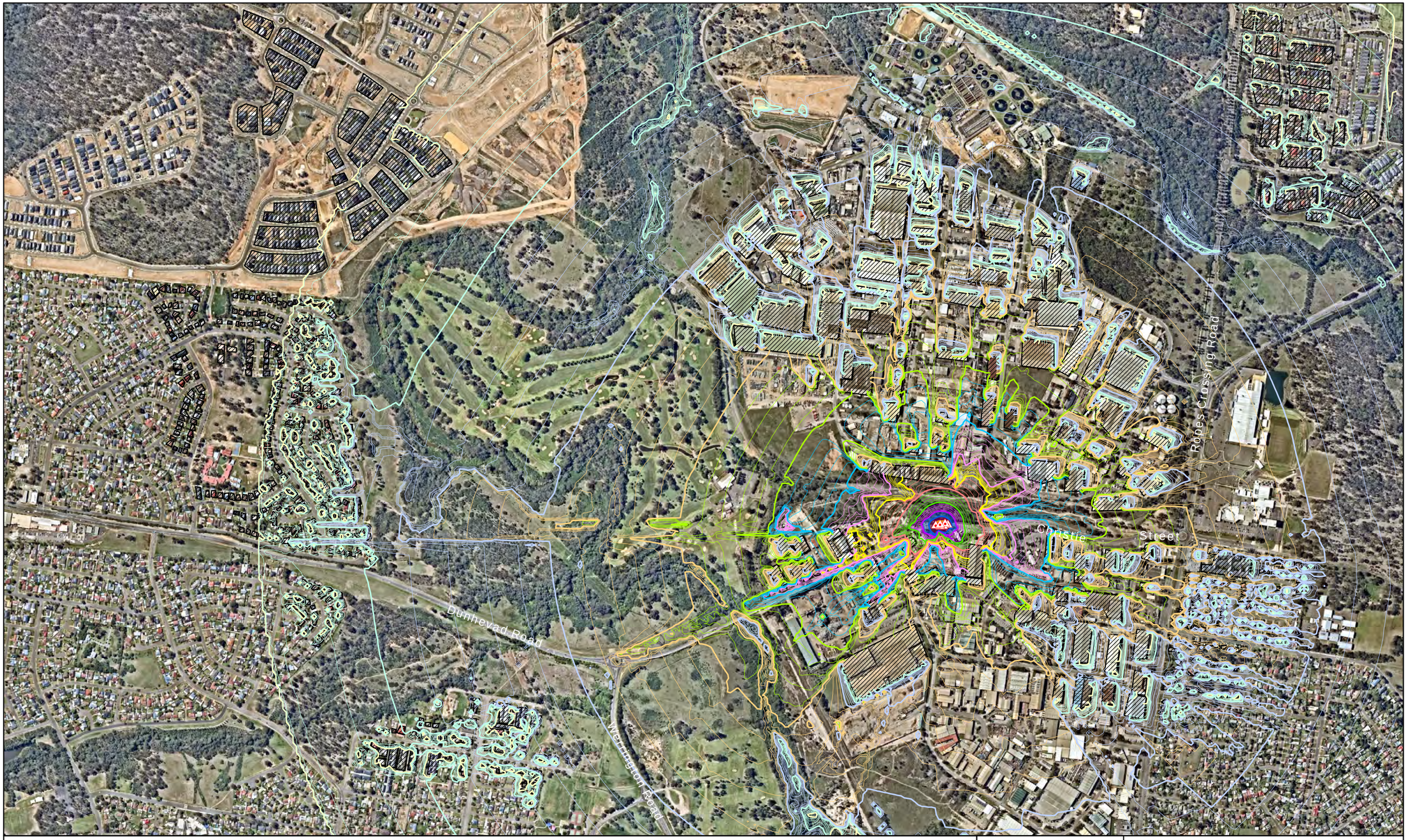
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GEOTECHNICAL • ENVIRONMENTAL

CONSTRUCTION SCENARIO 7
NIGHT SURFACE PREPARATION
CHRISTIE STREET INTERSECTION
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0	
DRAWN BY	NP	SCALE	1:10,000 (A3)	DRAWING	11	REV 0
APPROVED BY	AR	DATE	6/11/2018	OFFICE	NEWCASTLE	

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LEGEND

Modelled Buildings

Construction plant

L_{Aeq} Noise Contours, dB

30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-100

Note:
Aerial image taken from Nearmap, October 3 2018
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N

0 100 200 400 600 800
metres

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CONSTRUCTION SCENARIO 8
NIGHT EARTHWORKS
CHRISTIE STREET INTERSECTION
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0
DRAWN BY	NP	SCALE	1:10,000 (A3)	DRAWING 12	REV 0
APPROVED BY	AR	DATE	6/11/2018	OFFICE	NEWCASTLE

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Rapes Crossing Road

Christie Street

Dunnevad Road

Werrington Road

LEGEND

Modelled Buildings

Construction plant

L_{Aeq} Noise Contours, dB

30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-100

Note:
Aerial image taken from Nearmap, October 3 2018
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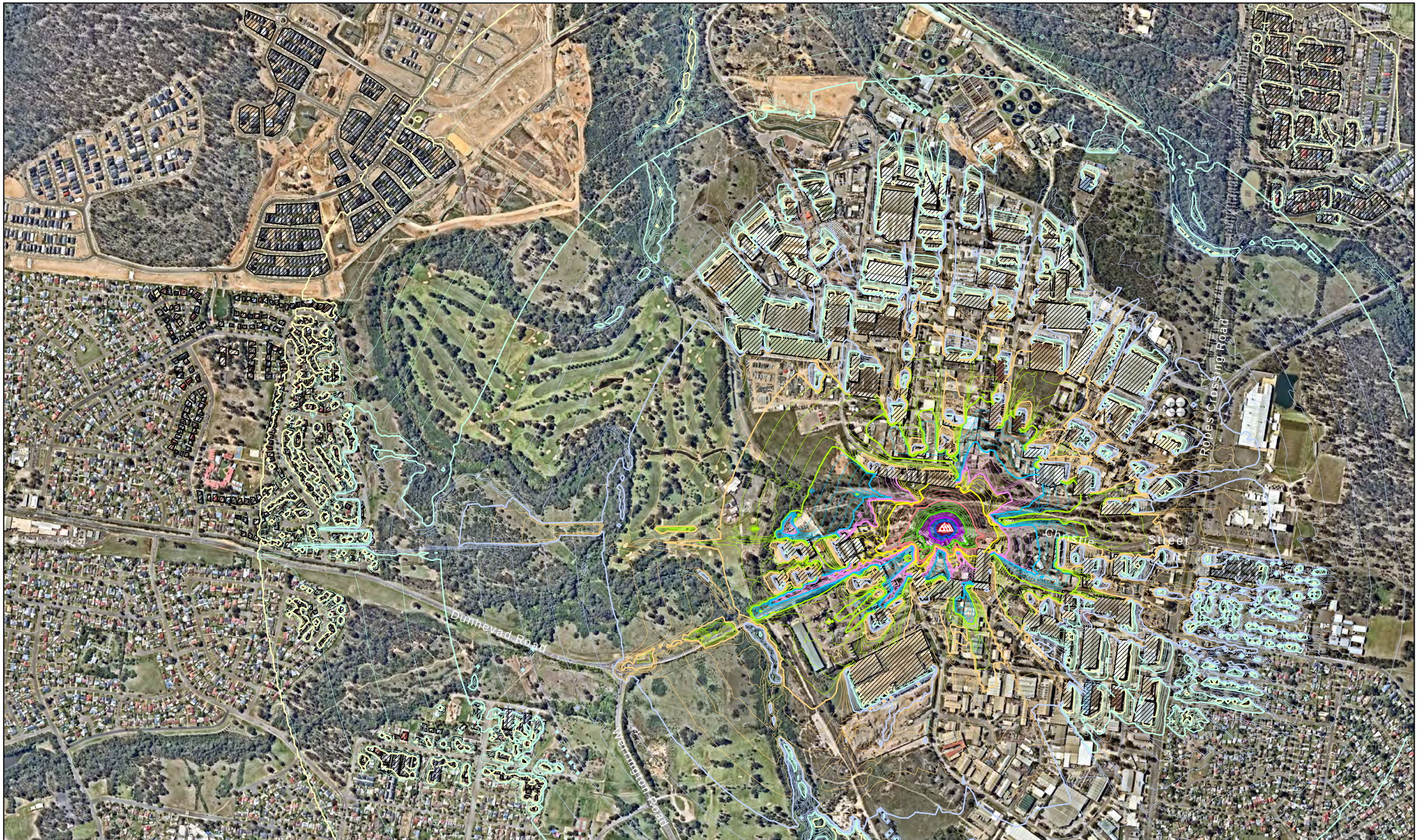
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CONSTRUCTION SCENARIO 9
NIGHT DRAINAGE WORKS
CHRISTIE STREET INTERSECTION
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0	
DRAWN BY	NP	SCALE	1:10,000 (A3)	DRAWING	13	REV 0
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LEGEND

Modelled Buildings

Construction plant

L_{Aeq} Noise Contours, dB

30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-95
46-50	71-75	96-100

Note:
Aerial image taken from Nearmap, October 3 2018
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N

0 100 200 400 600 800
metres

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CONSTRUCTION SCENARIO 10
NIGHT ROAD SURFACING
CHRISTIE STREET INTERSECTION
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0
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Dunmore Road

Werrington Road

Rooty Hill Road

Christie Street

LEGEND

Modelled Buildings

Construction plant

L_{Aeq} Noise Contours, dB

30	51-55	76-80
31-35	56-60	81-85
36-40	61-65	86-90
41-45	66-70	91-94
46-50	71-75	

Note:
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0 100 200 400 600 800
metres

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CONSTRUCTION SCENARIO 11
NIGHT TIE-IN WORKS
CHRISTIE STREET INTERSECTION
LINKS ROAD
ST MARYS ROAD NOISE ASSESSMENT

CLIENT	WSP			RCA Ref	13810-401/0
DRAWN BY	NP	SCALE	1:10,000 (A3)	DRAWING 15	REV 0
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APPENDIX E

ABORIGINAL CULTURAL HERITAGE ASSESSMENT REPORT

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Links Road Extension, St Marys

Aboriginal Archaeological Survey Report

Report to WSP Australia Pty Limited

City of Penrith Local Government Area

October 2018

artefact

Artefact Heritage
ABN 73 144 973 526
Level 4, Building B
35 Saunders Street
Pyrmont NSW 2009
Australia

+61 2 9518 8411
office@artefact.net.au

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Final draft	26 October 2018				Client review	Final draft issued to client
Final	31 October 2018	Michael Lever			Address client comments	Final

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Project manager:	Michael Lever
Name of organisation:	Artefact Heritage Services Pty Ltd
Name of project:	Links Road Extension, St Marys
Name of document:	Links Road Extension, St Marys – Aboriginal Archaeological Survey Report
Document version:	Final draft

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EXECUTIVE SUMMARY

Artefact Heritage Services Pty Ltd (Artefact Heritage) has been engaged by WSP Australia Pty Ltd on the behalf of Lendlease to prepare an archaeological survey report (ASR) for the upgrade and extension of Links Road, St Marys.

Background research indicates the northern part of the current study area is on the border of the Dunheved Precinct which comprises a zone defined as containing moderate potential for intact archaeological evidence (JMCHM 2004:34) (Figure 4.2). Other archaeologically sensitive areas include South Creek and Ropes Creek andat its closest point the study area is 120 m from South Creek. There are no previously registered Aboriginal sites within the study area but there are five registered Aboriginal sites within 200 m (metres). These predominantly comprise stone artefact scatters.

Land use in the local area has largely consisted of stock grazing, and transportation by road and rail. Ground disturbance from the construction of the roadways and railway is significant, and potentially will have disturbed Aboriginal sites to some extent. The impact from stock grazing is likely to be minimal in comparison. Alteration of water courses to create dams is likely to have resulted in significant localised disturbance in those areas.

An archaeological survey of the site was undertaken on the 25 September 2018. Mr Steve Randall attended on behalf of the Deerubbin Local Aboriginal Land Council (Deerubbin LALC).

The Aboriginal archaeological survey found:

- No Aboriginal archaeological site or areas of potential archaeological deposit (PAD) are located within the study area.

The following recommendations are made:

- Any changes to the scope of the proposal, such as a change in impact footprint, may require further archaeological survey and reporting
- No Aboriginal objects have been identified within the study area. Works can proceed with caution, without further archaeological investigation. If unforeseen Aboriginal objects are uncovered during construction, work should cease, and an archaeologist, the Office of Environment and Heritage and the Deerubbin LALC must be informed.
- If suspected human remains are located during any stage of the proposed works, work must stop immediately, and the NSW Police must be notified. The Office of Environment and Heritage must be notified if the remains are found to be Aboriginal ancestral remains.

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Table 4.1: Frequency of site features from AHIMS data ..... **Error! Bookmark not defined.**

Table 5.1: Survey coverage summary – survey units 29

Table 5.2: Survey coverage summary – landforms 29

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ABBREVIATIONS

ADI Site	Australian Defences industries
ACHAR	Aboriginal Cultural Heritage Assessment Report
AHIP	Aboriginal Heritage Impact Permit
AHIMS	Aboriginal Heritage Information System
AHMS	Archaeological and Heritage Management Solutions
ALR Act	*Aboriginal Land Rights Act 1983*
Artefact Heritage	Artefact Heritage Services Pty Ltd
ASR	Archaeological Survey Report
ATSHIP Act	*Aboriginal and Torres Strait Islander Heritage Protection Act 1984*
BCC	Blacktown City Council
BP	Before Present (that is 1950)
Consultation Requirements	Aboriginal cultural heritage consultation requirements for proponents 2010
Code of Practice	Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales 2010
DCP	Development Control Plan
DECCW	Department of Environment, Climate Change and Water (now OEH)
Due Diligence Code of Practice	Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales
EPBC Act	*Environment Protection and Diversity Conservation Act 1999*
GML	Godden Mackay Logan Heritage Consultants
Guide	Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW
GPS	Global Positioning System
ha	hectares
km	kilometres
KNC	Kelleher Nightingale Consulting Pty Ltd
JMCHM	Jo McDonald Cultural Heritage Management
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area

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m	metres
mm	millimetres
NHL	National Heritage List
NPW Act	*National Parks and Wildlife Act 1974*
OEH	Office of Environment and Heritage
PAD	Potential Archaeological Deposit
RNE	Register of the National Estate
RAP	Registered Aboriginal Party
REF	Review of Environmental Factors
ROS	Regional Open Space
Roads and Maritime	Roads and Maritime Services
SMM	Strategic Management Model
SMDS	St Marys Development Site

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1.0 INTRODUCTION

1.1 Background

This Aboriginal Archaeological Survey Report (ASR) has been prepared by Artefact Heritage Services Pty Ltd (Artefact Heritage) on behalf of WSP Australia Pty Ltd for the upgrade and extension to Links Road as shown on Figure 1.1. This ASR will form part of the documentation in support of the Development Application.

This ASR has been prepared in accordance the following guidelines:

- Code of Practice for Archaeological Investigation of Aboriginal objects in NSW (Code of Practice) (Department of Environment, Climate Change & Water [DECCW] 2010)
- Burra Charter (ICOMOS 2013).

1.2 Study area description and location

The Project comprises the following components (the study area):

- The upgrade of the existing Links Roads from the Dunheved Precinct to Dunheved Golf Club
- The extension of Links Road to Christie Street
- Construction of a new intersection at the intersection Christie Street and Lee Holm Road.

The study area consists of a 1.2 kilometre (km) of Links Road St Marys, situated approximately 350 m south of Triggs Street junction, extending to Dunheved Golf Club and including an extension to Christie Street and a planned future intersection (Figure 1.1). The study area includes any pavements, kerb and gutter, footpaths and drainage lines associated within the road easement. The study area measures approximately 78,319 square metres. A section of the study area between Triggs Street and an unnamed road was not surveyed as it had previously been assessed and a compound has already been built on the land.

The study area falls within the Parish of Melville and County of Cumberland, and is within the boundaries of the the Deerubbin Local Aboriginal Land Council (Deerubbin LALC).

1.3 Aims and objectives

The primary aim of this ASR is to identify whether any Aboriginal objects or areas of archaeological potential would be impacted by the Project and provide recommendations as to whether further archaeological investigation may be required.

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The main objectives of this ASR are to comply with the Code of Practice. This ASR provides:

- A description of the proposal and the extent of the study area
- A description of Aboriginal community involvement and Aboriginal consultation
- Discussion of the environmental context of the study area
- Discussion of the Aboriginal historical context of the study area
- A summary of the archaeological context of the study area including a discussion of previous archaeological work in the area
- Development of an archaeological predictive model
- Description of Aboriginal sites within the study area
- Development of a significance assessment for these sites addressing archaeological values
- Impact assessment for Aboriginal sites in the study area
- Recommendations for management and mitigation measures for Aboriginal sites.

1.4 Authorship

Anna Darby (Heritage Consultant, Artefact Heritage) completed the archaeological survey and wrote this report. Anna has a Bachelor of Science (Honours) and has three years' experience in archaeological fieldwork including Aboriginal cultural heritage surveys across the Sydney Basin.

Michael Lever (Senior Heritage Consultant, Artefact Heritage) managed the project, supervised the archaeological survey and provided input and review to the report. Michael has a Bachelor of Arts (Hons) in archaeology, is a current PhD candidate in archaeology at the University of Sydney and has eight years' experience in archaeological survey in NSW, Victoria and WA.

Vanessa Edmonds (Principal, Artefact Heritage) provided project direction and technical review. Vanessa has a Masters degree in Archaeology and Palaeoanthropology and has over 30 years' experience undertaking Aboriginal cultural heritage surveys nationwide.

1.5 Aboriginal community involvement

An archaeological survey of the site was undertaken on the 25 September 2018. Mr Steve Randall attended on behalf of the Deerubbin LALC.

1.6 Report structure

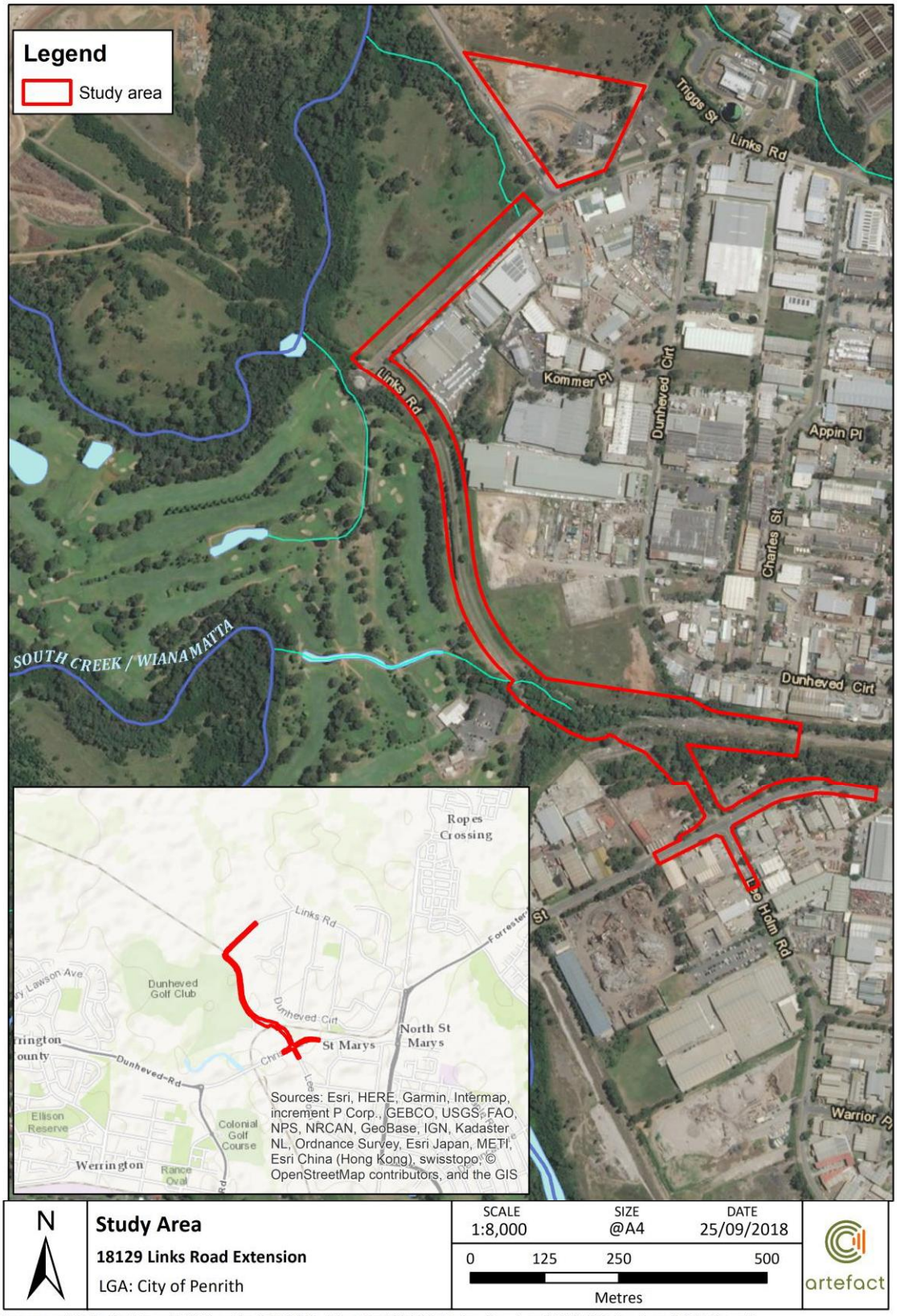
- **Section 2 - Legislative context**: outlines relevant legislation for this assessment
- **Section 3 - Environmental context:** Provides a succinct overview of the environmental context of the proposal
- **Section 4 - Aboriginal historical and archaeological context:** Provides an overview of the Aboriginal history of the area and the results of previous archaeological investigation
- **Section 5 - Archaeological survey:** Describes the survey conducted for this assessment
- **Section 6 – Results and discussion**: Provides a discussion of the results of the site survey
- **Section 7 - Significance assessment:** Provides an assessment of the archaeological significance of the study area

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- **Section 8 - Management measures:** Outlines relevant management and mitigation measures for the proposal.
- **Section 9 – Recommendations:** Outlines recommendations for future assessment as required

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Figure 1.1: Study area Links Road, St Marys



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2.0 LEGISLATIVE CONTEXT

2.1 State legislation

2.1.1 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides statutory protection to all Aboriginal Places and objects. An Aboriginal object is defined by the NPW Act as:

> *any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.*

An Aboriginal Place is declared by the Minister, under Section 86 of the NPW Act, in recognition of its special significance with respect to Aboriginal culture. However, areas are only gazetted as Aboriginal Places if the Minister is satisfied that sufficient evidence exists to demonstrate that the location was and/or is of special significance to Aboriginal culture. Aboriginal Places gazetted under the NPW Act are listed on the State Heritage Register established under the *Heritage Act 1977*.

The protection provided to Aboriginal objects applies irrespective of the level of their significance or issues of land tenure. Aboriginal objects and places are afforded automatic statutory protection in NSW whereby it is an offence to knowingly or unknowingly harm or desecrate an Aboriginal object or Aboriginal Place under Section 86 of the NPW Act.

In accordance with Section 89A any person who is aware of the location of an Aboriginal object must in the prescribed manner, notify the Chief Executive within a reasonable time after the person first becomes aware of that object. The prescribed manner is to complete an Aboriginal Heritage Information Management System (AHIMS) Aboriginal Site Recording Form (DECCW 2010: 14)

In order to undertake a proposed activity which is likely to involve harm to an Aboriginal Place or object, it is necessary to apply to the Office of Environment and Heritage (OEH) for an Aboriginal Heritage Impact Permit (AHIP). AHIPs are issued by OEH under Section 90 of the NPW Act, and permit harm to certain Aboriginal objects or Aboriginal Places.

There are no gazetted Aboriginal places within the proposal areas. All Aboriginal objects, whether recorded or not, are protected under the NPW Act.

2.1.2 Native Title Act 1994

The *Native Title Act 1994* was introduced to work in conjunction with the Commonwealth *Native Title Act 1993*. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act. A search of the Native Title Register was carried out on the 20 September 2018. There are no Native Title claims currently registered in the study area.

2.1.3 Aboriginal Lands Right Act 1983

The *Aboriginal Land Rights Act 1983* (ALR Act) established Aboriginal Land Councils (at State and Local levels). These bodies have a statutory obligation under the ALR Act to:

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(a) take action to protect the culture and heritage of Aboriginal persons in the council's area, subject to any other law, and

(b) promote awareness in the community of the culture and heritage of Aboriginal persons in the council's area.

The study area is within the boundary of the Deerubbin LALC.

2.1.4 *Environmental Planning and Assessment Act 1979*

The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process. The EP&A Act consists of three main parts of direct relevance to Aboriginal cultural heritage; Part 3 which governs the preparation of planning instruments, Part 4 which relates to development assessment processes for local government (consent) authorities, and Part 5 which relates to activity approvals by governing (determining) authorities.

Planning decisions within LGAs are guided by Local Environmental Plans (LEPs). Each LGA is required to develop and maintain and LEP that includes Aboriginal and historical heritage items which are protected under the EP&A Act and the *Heritage Act 1977*. The study area is located in the Penrith City LGA and is subject to consents under the Penrith LEP 2015. The study area is also subject to the St Marys Regional Environmental Plan No 30 (2001).

The objectives of the Penrith Local Environmental Plan relevant to management of archaeology and Aboriginal cultural heritage(LEP) Part 5; Section 5.10 (Penrith City Council 2010) are to;

- Conserve archaeological sites
- Conserve Aboriginal objects and places of heritage significance

The St Marys Regional Environmental Plan (2001) provides a framework for management of archaeological and Aboriginal heritage values to which consent authorities must adhere.

Penrith City Council is the consent authority for the current Project.

This ASR provides an assessment of the Project impacts.

2.2 Commonwealth legislation

2.2.1 *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legislative framework for the protection and management of matters of national environmental significance, that is, flora, fauna, ecological communities and heritage places of national and international importance. Heritage items are protected through their inscription on the World Heritage List (WHL), Commonwealth Heritage List (CHL) or the National Heritage List (NHL).

Under Part 9 of the EPBC Act, approval under the EPBC Act is required for any action occurring within, or outside, a Heritage place that has, will have, or is likely to have a 'significant impact' on the heritage values of a World, National or Commonwealth heritage listed property (referred to as a 'controlled action' under the Act).

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A 'significant impact' is defined as:

> an impact which is important, notable, or of consequence, having regard to its context or intensity. If an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

The EPBC Act stipulates that a person who has proposed an action that will, or is likely to, have a significant impact on a site that is listed on the WHL, NHL or CHL must refer the action to the Minister for Sustainability, Environment, Water, Population and Communities (hereafter the Minister). The Minister will then determine if the action requires approval under the EPBC Act. If approval is required, an environmental assessment would need to be prepared. The Minister would approve or decline the action based on this assessment.

There are no CHL, WHL, or NHL listed sites within the study area.

2.2.2 Australian Heritage Council Act 2003

The Register of the National Estate (RNE) is an evolving record of Australia's natural, cultural and Aboriginal heritage places that are worth keeping for the future. The Australian Heritage Commission compiles and maintains the RNE under the *Australian Heritage Council Act* 2003. Places on the RNE that are in Commonwealth areas, or subject to actions by the Australian Government, are protected under the EPBC Act by the same provisions that protect Commonwealth heritage places (see above).

Following amendments to the *Australian Heritage Council Act* 2003*,* the RNE was frozen on 19 February 2007, meaning no new places can be added, or removed. The RNE is now maintained on a non-statutory basis as a publicly available archive within the Australian Heritage Database and contains over 13,000 places including many places of local or State significance. A search of the RNE was carried out on the 20 September 2018.

One site, King Family Farm sites and Trees, Links Road, St Marys, is listed on the RNE and is in the northern portion of the study area. The King Family Farm Sites date from ca.1807 and comprises the Dunheved and the Elizabeth King Farm archaeological sites and nineteenth century trees, including pines on the western bank of South Creek and an olive tree, a mock orange tree, some pines trees and kurrajong trees at Dunheved.

2.2.3 Aboriginal and Torres Strait Islander Heritage Protection Act 1984

The Commonwealth *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (ATSIHP Act), deals with Aboriginal cultural property (intangible heritage) in a wider sense. Such intangible heritage includes any places, objects and folklore that 'are of particular significance to Aboriginals in accordance with Aboriginal tradition'. These values are not currently protected under the NPW Act.

There is no cut-off date and the ATSIHP Act may apply to contemporary Aboriginal cultural property as well as ancient sites. The ATSIHP Act takes precedence over state cultural heritage legislation where there is conflict. The Commonwealth Minister who is responsible for administering the ATSIHP Act can make declarations to protect these areas and objects from specific threats of injury or desecration. The responsible Minister may make a declaration under Section 10 of the Commonwealth Act in situations where state or territory laws do not provide adequate protection of intangible heritage.

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Where an Aboriginal individual or organisation is concerned that intangible values within the proposal are not being adequately protected they can apply to the Minister for a declaration over a place.

No intangible places were identified during the survey or background research.

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3.0 ENVIRONMENTAL CONTEXT

The environmental context of the study area is to assist in the prediction of:

- The potential of the landscape over time to have accumulated and preserved Aboriginal objects
- The ways Aboriginal people may have used the landscape in the past with reference to the presence of resource areas, surfaces for art, and other focal points for activities and settlement
- The likely distribution of the material traces of Aboriginal land use based on the above.

3.1 Environmental background

The study area is located within the Cumberland Plain, a large low-lying and gently undulating landform in the Sydney Basin. The formation of the basin began between 300 to 250 million years ago when river deltas gradually replaced the ocean that had extended as far west as Lithgow (Pickett and Alder 1997). The oldest Permian layers of the Sydney Basin consist of marine, alluvial and deltaic deposits that include shales and mudstone overlain by Coal Measures. By the Triassic period the basin consisted of a large coastal plain, with deposits from this period divided into three main groups, the Narrabeen Group, Hawkesbury Sandstone and the Wianamatta Group (Clark and Jones 1991; Pickett and Alder 1997).

The geology of the study area is characterised by the Triassic Wianamatta Liverpool Sub-Group. The Liverpool Sub-Group comprises Bringelly Shale over Hawkesbury Sandstone and Ashfield Shale and consists of shale and some sandstone beds and outcrops. Local relief is between 10 m and 50 m with undulating slopes of less than ten per cent (Bryan 1966). The Cumberland Plain is known for its source of silcrete at Rouse Hill. This source of silcrete was used by Aboriginal people in artefact manufacture and can be found in Aboriginal sites across the Cumberland Plain. Another significant archaeological feature of the regional geological landscape isa source of silcrete at Plumpton Ridge, approximately 10 kilometres northeast of the study area. The silcrete raw material source at Plumpton Ridge was an important and extensively used quarry where extraction and tool manufacture activities took place (Jo McDonald Cultural Heritage Management (JMCHM) 2006). Archaeological investigations within the former Australian Defence Industry St Marys site have also identified several silcrete quarries approximately two kilometres north east of the study area (JMCHM and GML 2013).

Soils in the study area consist of the residual Blacktown soil landscape, Berkshire Park soil landscape and the South Creek soil landscape (Hazelton 1992). The Blacktown soil landscape is typified by shallow duplex soils over a clay base. The biomantle is underlain by heavily textured subsoil with a depth of generally less than a metre, and most commonly less than 300 millimetres (mm). The archaeological implications of this soil landscape are that intact deposits are likely to occur in the A horizon, which is generally up to 300 mm in depth, and that stratigraphic potential would be limited.

The Berkshire Park soil landscape usually occurs on gently undulating low rises on the tertiary terraces of the Hawkesbury/Nepean River system. The soils are orange and often mottled weakly pedal heavy clays and clayey sands with ironstone nodules and large (up to 200 mm) silcrete boulders that occur in a sand clay matrix (Bannerman and Hazelton 1990). The South Creek soil landscape usually contains floodplains, valley flats and drainage depressions of the channels on the Cumberland Plain. South Creek soils are often very deep layered sediments over bedrock or relict soils. Plastic clays or structured loams occur in and immediately adjacent to drainage lines. red and yellow podzolic soils are most common on terraces with small areas of structured grey clays, leached clay and yellow sodic soils (Bannerman and Hazelton 1990).

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The region has a dense drainage network of north flowing channels. South Creek, a major tributary of the Hawksbury- Nepean River passes at closest 120 m to the west of the study area while Ropes Creek is 900 m to the north east of the study area. Both creeks are fourth order streams. An unnamed tributary of South Creek dissects the study area.

Historically, the study area would have been vegetated by Cumberland Plain woodland communities, consisting largely of open sclerophyll forests. Significant land clearance throughout the period of European occupation has removed the majority of this ecological community from the study area. Vegetation data relating to the soil landscapes within the study area is useful in predicting past ecological systems available to Aboriginal people.

Within areas containing Blacktown soils original open forests were dominated by Forest Red Gum (*Eucalyptus tereticornis*), Narrow-leaved Ironbark (*E. crebra)*, Grey Box, (*E. moluccana)*, and Spotted Gum (*E. maculate).* Understory vegetation would have consisted of Woollybutt (*E. longifolia)* and a collection of shrubs and grasses. Additional species within this area include Broad-leaved Apple (*Angophora subvelutina)*, Cabbage Gum (*E. amplifolia)* and Swamp Oak (*Casuarina glauca)*, along with still water species such as Tall Spike Rush (*Eleocharis ephacelata).*

Within areas containing the Berkshire Park soils, very little natural vegetation remains other than in Castlereagh State Forest, which contains three vegetation associations based on Broad-leaved Ironbark (*E. fibrosa*), Narrow-leaved Apple (*Angophora bakeri*), and Scribbly Gum (*E. sclerophylla*) (Murphy, 1973). Paperbarks (*Melaleuca decora* and *M. nodosa*) often occur as a small tree layer (Benson, 1981). The shrub understorey species are dominated by members of the families Fabaceae, Papilionaceae, Sapindaceae, Proteaceae and Myrtaceae.

Faunal communities throughout the study area consisted of terrestrial mammals such as Eastern Grey kangaroos, wallabies, wombats and a variety of possums. Freshwater bird species such as ducks and swans would also have inhabited that waterways, along with freshwater fish and shellfish. Insects, reptiles, and tree dwelling birds would also have provided access to a number of subsistence resources.

The study area would likely have once comprised an attractive area for Aboriginal habitation. The study area is well resourced - it is situated on a gently undulating plain and is near permanent sources of water. Vegetation in the study area once comprised a varied mosaic of open forest and creek-side species. These would have provided dietary and manufacturing resources, and likely supported a wide range of faunal resources. Substantial resources for stone tool manufacture have been documented within short to medium distance of the study area, adding further to the viability of habitation in the location.

3.2 Historical background and land use

The township of St Marys was originally centred along the banks of the South Creek and at first the Township was named for the creek. The land was first surveyed by Europeans, and land grants issued in 1803. These land grants became working holdings due to the permanent water supply. The rich alluvial soil along the banks of the creek supported an expanding agricultural community. The location of the township on what was then called the Great Western Road, later renamed to the Great Western Highway, meant that the township became a convenient staging post. The King family were free settlers and in 1806, Governor Philip Gidley King granted his legitimate children Elizabeth, Maria, Mary, Philip Parker and his wife Anna Josepha, some thousands of acres in the area. All the King grants operated as the Farm, where they grazed large herds of cattle and cultivated crops (Australian Heritage Database 2018).

By the 1840s, St Marys had begun to emerge as a small village located on the Great Western Road, located at the South Creek crossing. The village contained a simple but substantial church, St Mary

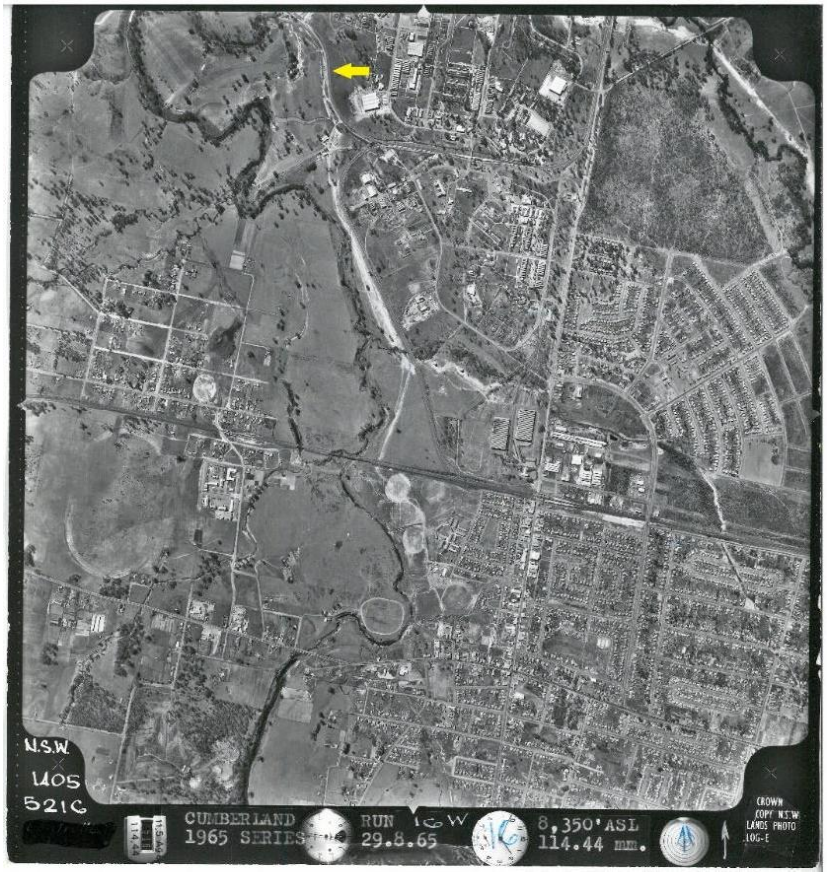
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Magdalene, endowed by the King family which was completed in 1840 (Paul Davies Pty Ltd 2007). The railways constructed from the early 1850s changed the Penrith district. Once the railway was extended from Parramatta to Penrith in 1863, new avenues for earning a livelihood became possible. The railway itself provide employment, and local economy was boosted through the supply of timber for fencing and railway sleepers. The timber-getting industry of Western Cumberland became established at that time, and gradually during the nineteenth century, after the building of the railway, the forests which clothed the gentle undulating hills stretching from Prospect to the Nepean were cut out.

The Australian Defence Industries (ADI) site at St Marys contained various factories and infrastructure associated with the war effort. Since the mid 1930s tensions in Europe and Asia had been growing, the Australian government had begun investing in the construction of munitions factories, and by 1939 there were six factories operating in Australia (CMP). The St Marys site was chosen for its proximity to the rail line and the western highway, as well as the availability of water and local power. Due to large distances between the factories they were linked by a series of roads and an internal railway line that ran as a branch from the main western line at St Marys. The now abandoned Ropes Creek railway line was built in 1942 and closed in 1986 but the main line was never lifted (Lost Railways 2018).

The north section of the study area is located within the ADI site St Marys, while the majority is located within a zone that has historically been characterised as rural or semi-rural in nature. The dominant activities within the vicinity from the nineteenth century onwards have been a mix of agricultural pursuits, including pastoralism, wheat and maize cropping, dairy farming, poultry farming and orchards (Casey and Lowe 1993).

Figure 3.1: 1965 aerial photograph of St Marys, Links Road indicated by the yellow arrow



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3.3 Summary

The study area is located within a well-watered landscape with abundant food and raw material resources including a good quality stone resource (silcrete) for the manufacture of stone tools.

Land use in the local area has largely consisted of stock grazing, and construction of road and rail infrastructure. Ground disturbance from the construction of the roadways and railway is significant and may potentially have disturbed Aboriginal sites. The impact from stock grazing is likely to be minimal in comparison. Alteration of water courses to create dams is likely to have resulted in significant, localised disturbance in those areas.

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4.0 ABORIGINAL CONTEXT

4.1 Aboriginal histories of the locality

Traditional Aboriginal tribal boundaries within Australia have been reconstructed, primarily, based on surviving linguistic evidence and are therefore only approximations. Social interaction, tribal boundaries and linguistic evidence may not always correlate, and it is likely boundaries and interaction levels varied and fluctuated over time. The language group spoken on the Cumberland Plain is known as Darug (Dharruk – alternative spelling). This term was used by non-Indigenous scholars for the first time in 1900 by Matthews and Everitt (1900). The Darug language area is thought to have extended from Appin in the south to the Hawkesbury River, west of the Georges River, Parramatta, the Lane Cove River and to Berowra Creek (Attenbrow 2010). This area was home to a number of different clan groups.

Aboriginal people have lived in the Sydney region for up to 30,000 years, as indicated by radiocarbon dating undertaken on a sample from a site in Parramatta (Jo McDonald Cultural Heritage Management (JMCHM) 2005). Evidence of Aboriginal occupation has been found dated to around 47,000 to 50,000 years at Lake Mungo in western NSW (Bower et al 2003) so it is likely that Aboriginal people have lived in the Sydney region for even longer than indicated by the oldest recorded dates known at present. The archaeological material record provides evidence of this long occupation, and provides evidence of a dynamic culture that has changed through time.

The first official contact between colonial settlers and the Darug people occurred in 1790, when Sir Arthur Phillip's party encountered a group of Aboriginals near the banks of the Hawkesbury River close to Richmond (Kohen 1986; Karsken 1991). The following years saw colonial expansion into western Sydney and as a result, a number of conflicts arose. These were particularly frequent between 1797 and 1805, specifically in the Parramatta-Toongabbie region and the Hawkesbury and Georges River areas. This conflict continued in some extent for more than 20 years and has been recently assessed as far more intense than previously depicted (Gapps 2018). The Aboriginal population declined rapidly. Reverend William Walker listed nine tribes in the Sydney region in the 1820s, but only listed three as being numerous. According to the 1839 annual blanket distribution, there were only 103 Aboriginal people in the whole Windsor district from Putty and Colo through Richmond and Kurrajong to South Creek (Milliss 1992). At first Darug people maintained their traditions and practices with an was an increase in the reliance on European materials such as clothing, food, and tools. By the later 19th century Aboriginal people were moved into missions and reservations through Government policy (Kohen 1986).

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4.2 Aboriginal Heritage Information Management System

The location of Aboriginal sites is considered culturally sensitive information. This section of the report has been redacted for public view

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4.3 Previous archaeological assessments

Artefact Heritage 2013 – Victoria Street, Werrington

In 2013 Cardno engaged Artefact Heritage to conduct a due diligence assessment of the proposed residential development at Victoria Street, Werrington, approximately 2 km south west of the current study area.

No Aboriginal objects or sites were identified during the site inspection. Minimal ground surface impacts were observed and it was identified that intact archaeological deposits containing Aboriginal objects were likely to be present in the study area. Further investigation into the potential for underlying archaeological objects was recommended.

Godden Mackay Logan Heritage Consultants and JMCHM 2013- St Marys Development Site, Central Precinct

Godden Mackay Logan Heritage Consultants (GML) and JMCHM were engaged by Maryland Development Company Pty Ltd to prepare an Aboriginal Cultural Heritage Assessment Report (ACHAR) and an Archaeological Technical Report (ATR) for the Central Precinct located within the St Marys Development Site (SMDS) former Australian Defence Industries (ADI) St Marys, adjacent to the northern portion of the current study area (Figure 4.1). The report found that the SMDS is of very high social and cultural importance to the Darug people due to its preserved evidence of continued Aboriginal occupation, and the presence of a number of complex sites located within and in close proximity to the area. The local Darug community also stressed the importance of South Creek (which runs through the centre of the SMDS) as a significant and important location to the people of that area, used as an important mode of communication and meeting place for trade.

Archaeological test excavations were undertaken across six target areas on the site. These resulted in 157 test units for a total of 43.75 square metres excavated across the entire study area. A total 266 lithic artefacts were recovered from the test excavation of the Central Precinct. Two excavation areas demonstrated low to moderate potential for stratified archaeological deposits, while one area demonstrated a very high potential for stratified deposits. The northern portion of the study area of this ASR falls within the area outlined by GML and JMCHM (2013) as of moderate potential for stratified archaeological remains.

GML and JMCHM (2013) instigated management zones across the SMDS. These identified management strategies specific to each area of the precinct. Management strategies include salvage excavation, public interpretation, topsoil monitoring and Aboriginal community collection of artefacts, conservation, and management of Aboriginal stone objects. The report recommended that the proponent of their report should apply for a Section 90 Aboriginal Heritage Impact Permit for the study area in order for the proposed development to proceed.

Archaeological and Heritage Management Solutions (AHMS) 2012 - Werrington Arterial Road (M4 Motorway – Great Western Highway), Claremont Meadows

NSW Roads and Maritime Services (Roads and Maritime) proposed to upgrade Gipps Street and Kent Road from the M4 Motorway to the Great Western Highway near Claremont Meadows, NSW, located approximately 3.4 km south east of the current study area. In December 2011, AHMS conducted an Aboriginal heritage assessment of the proposed upgrade route.

During the assessment it was found that there were a total of seven Aboriginal sites within the study area that were at risk of impact, with a further three sites located close to the study area boundary. Five of these sites were previously recorded sites not on the AHIMS database and five were new recordings. The sites included seven isolated finds, two artefact scatters and one potential

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archaeological deposit with artefacts. Several Aboriginal sites were recorded along a 30 m contour that runs parallel to South Creek within the study area. It was found that the frequency of recorded Aboriginal sites along the 30 m contour indicated that the ridge was used intensively by Aboriginal people in the past. This may be because the ridge is situated overlooking a rich resource zone. Test excavation was recommended, and an ACHAR was completed.

JMCHM 2009 –Archaeological assessment of Indigenous Heritage Values in the Central Precinct of the St Marys development site, St Marys

The Central Precinct is 300 m to the west of the current study area and comprises 133 hectare (ha) of land within the St Marys Development site. The Central Precinct's eastern boundary is formed by a 40 ha Regional Open Space (ROS) zone (Figure 4.1). JMCHM (2009) incorporated earlier work undertaken on the overall site (JMCHM 2004).

The results of the assessment show that 33 per cent of the Central Precinct has high conservation value (zone 1) and another 54 per cent has archaeological sensitivity (zones 2 and 3). The report identified five salvage locations within the Central Precinct and two in the ROS, salvage of these landscapes aimed to add a fundamental understanding of Aboriginal occupation of this area throughout its human occupation.

JMCHM 2004 – the Archaeological assessment of Indigenous Heritage Values in the Dunheved Precinct in the former ADI Site, St Marys

This report provides a Strategic Management Model (SMM) which identified previous land use disturbance and applied a predictive model. The aim of the archaeological SMM was the preservation of a representative sample of intact landscapes across the overall site to ensure that a range of human responses, as represented by the archaeology, were protected within the Dunheved Precinct. Four zones, each having a different designated management outcome were identified, ranging from very high potential for intact archaeological evidence - potential conservation zone (zone one) to Low - no potential for archaeological evidence - no further work required (zone four) (Figure 4.2).

The northern part of the current study area is on the border of the southern portion of the Dunheved Precinct which comprises of zone three, defined as containing moderate potential for intact archaeological evidence, and zone four (no potential for intact archaeological evidence). (Figure 4.1Figure 4.1). Ground truthing of the Dunheved Precinct, determined two locations requiring archaeological salvage. JMCHM concluded that a majority of the zone three and zone four areas, including the current study area did not require further archaeological investigations.

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Figure 4.1: The St Marys Development site showing development precincts. The Dunheved Precinct is in the south east of the former ADI Site, to the east of South Creek. Current study area in red (Source: JMCHM 2009: 7)

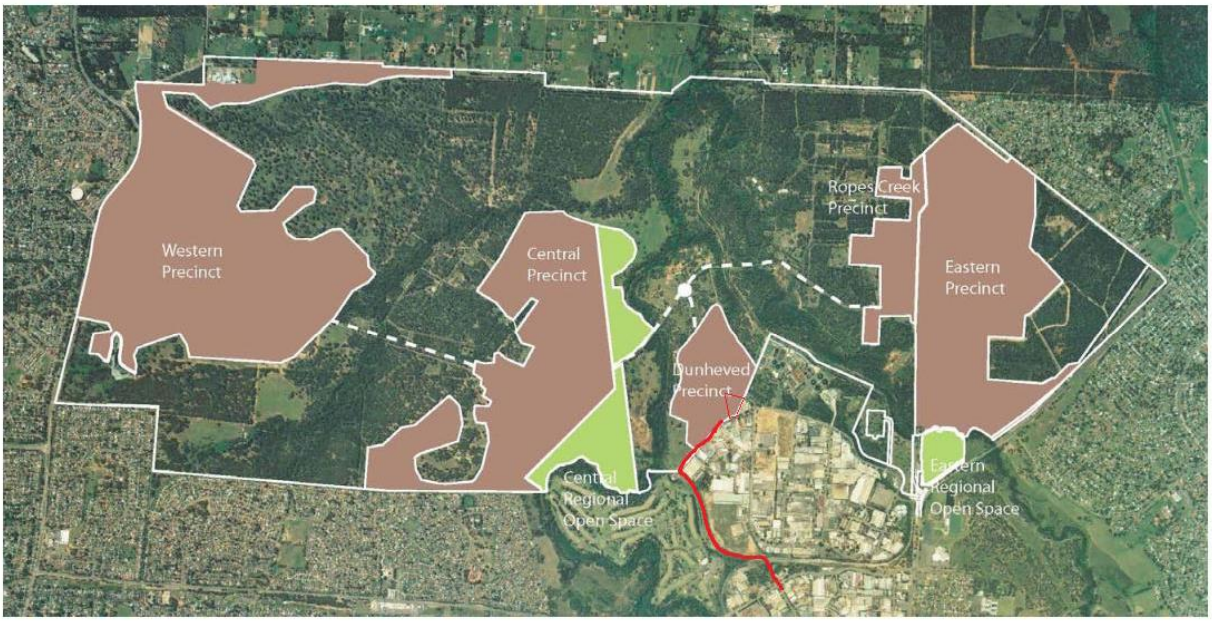
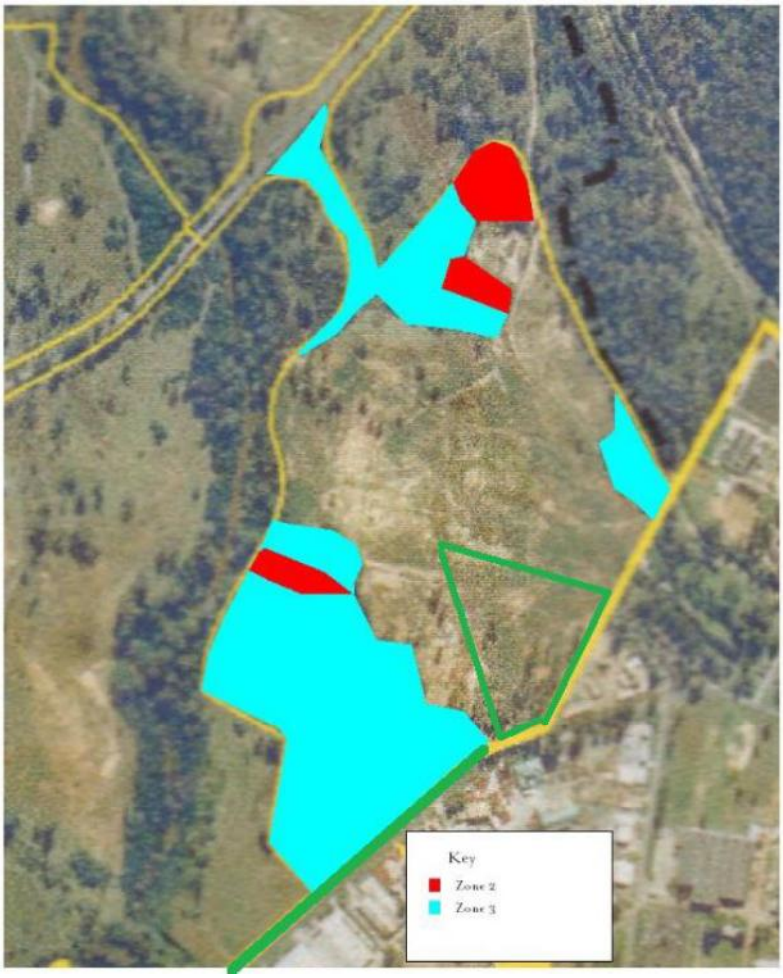


Figure 4.2: Dunheved Precincts Indigenous Heritage Zones, current study area in green



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4.4 Archaeological implications

Previous archaeological investigations in the locality have identified much of the landscape in the vicinity of the South Creek and Ropes Creek as archaeologically sensitive. In particular, several reports have identified the alluvial deposits as containing the potential for buried land surfaces and human remains, however these features have not been identified as yet in previous sub-surface excavations in the area.

While the significant impact of flooding has been noted several sites have been identified below the 1:100-year flood level. Raised slopes, spurs and crests have also been identified as areas likely to demonstrate archaeological potential.

One previous investigation (JMCHM 2004Figure 4.1) has identified a small part of the northern section of the study area as being of low/nil to moderate potential for intact archaeological evidence but requiring no further archaeological investigation.

Based on the background environment and previous archaeological assessments the following conclusions can be made regarding the archaeological sensitivity of the study area:

- The study area is located on the Cumberland Plain, a landscape which provides an excellent source of silcrete, for artefact manufacture
- Aboriginal sites in the study area are likely to comprise surface and sub-surface scatters of predominantly silcrete stone artefacts
- The study area comprises the Blacktown, Berkshire Park and South Creek soil landscapes. Approximately 70 per cent of the study area comprises of the South Creek Soil Landscape. The archaeological implications of this soil landscape is that the soils are often deep with the potential for intact archaeological deposits. The Berkshire Park soil landscape is also characterised by deep soils. The archaeological implications of the Blacktown soil landscape are that intact deposits are likely to occur in the A horizon, which is generally up to 300 mm in depth, and that stratigraphic potential would be limited.
- South Creek and Ropes Creek are both fourth order streams in proximity to the study area. Predictive modelling indicates that stone artefacts will more commonly be found within 50-100 m of fourth order creeks, with a drop-off to regional background densities of artefact deposits as distance increases from water. The study area is 120 m from South Creek at its closest point.
- Areas of PAD may be identified in association with water resources such as South Creek and its tributaries.
- The Dunheved Precinct study (JMCHM 2004) assessed part of the study area as being of low to moderate archaeological sensitivity and recommended the study area required no further archaeological investigation.
- Aboriginal objects within the study area are likely to be located in contexts that have been heavily disturbed due to road and rail development. The study area is likely to have also been disturbed through construction of existing services such as drainage, power, telecommunications and footpaths.

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4.5 Predictive model

The study area is located more than 50 m to 100m from permanent water and is not modelled as of high potential for Aboriginal archaeological cultural heritage material. Aboriginal sites have been recorded within 200 m of the study area. Based on the expected level of disturbance within the study area it is considered unlikely that intact archaeological deposits will be present within the study area. It is predicted that the study area may contain likely disturbed low density deposits of Aboriginal archaeological cultural heritage material.

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5.0 ARCHAEOLOGICAL SURVEY

5.1 Aims

The aims of the archaeological survey were to:

- Cover a representative sample of the study area that will potentially be impacted by the proposed works
- Reinspect any previously registered sites
- Record any new Aboriginal objects or sites observed during the survey
- Identify areas of potential archaeological deposit (PAD) that may be present in areas that have had no or minimal disturbance
- Liaise with the Deerubbin LALC regarding the proposed works and the archaeological potential of the study area
- Collect information to ascertain whether further archaeological investigation is required.

5.2 Timing and personnel

An archaeological survey was undertaken over one day on the 25 September 2018. The survey was supervised by Michael Lever (Senior Heritage Consultant, Artefact Heritage) with Anna Darby (Heritage Consultant, Artefact Heritage) and Mr Steve Randall (Deerubbin LALC) also in attendance.

5.3 Constraints

Small portions of the proposed development extend into private property adjacent to the road corridor. Private properties were not directly accessed during survey. Portions of the study area within private property were surveyed from the road corridor. A section of the study area between Triggs Street and an unnamed road was not surveyed as the area was understood to have been previously assessed and contained a works compound (see hatched area in Figure 5.1).

5.4 Methodology and coverage

Survey of the study area was undertaken on foot by a team of three who walked in transects along both sides of the road corridor in the study area. The area between Links Road and Christie Street contained an unsealed track.

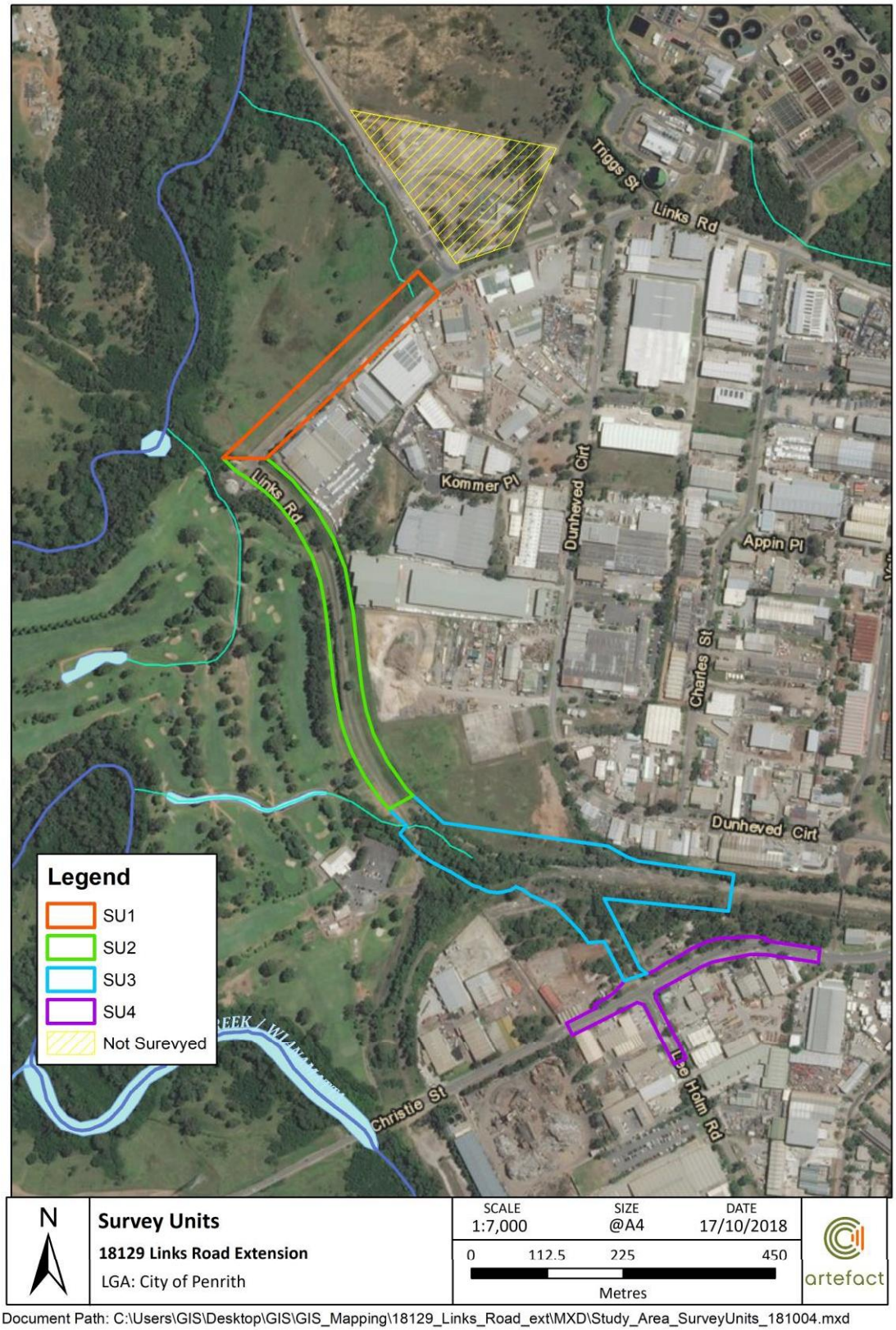
In areas where there was no road, transects were conducted spaced five to ten metres apart depending on the area. The study area was largely comprised of the Links Road easement from 84 Links Road to the southern end of Links Road.

A handhold non-differential Global Positioning System (GPS) was used to track the path of the survey team and record the coordinates of survey transects as well as the location of any Aboriginal sites.

A photographic record was kept during the survey. Photographs were taken to record aspects of survey units including surface exposures, vegetation, areas of surface disturbance, and any identified Aboriginal sites and areas of archaeological potential. Scales were used for photographs where appropriate as specified in the Code of Practice. Survey was delineated into four survey units based on four arbitrary sections. These are shown in Figure 5.1.

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Figure 5.1: Survey units



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5.4.1 Survey unit one

Survey unit one (SU1) consists of 380 metres of the north east - south west aligned section of Links Road (Figure 5.2).

The landscape within SU1 is a predominantly flat landscape with a gradient towards South Creek in the east. The carriageway has been cut into the landscape by approximately 200 mm, with the northern road shoulder mostly cleared and containing imported gravels, and a thin strip of grass (Figure 5.2). The southern road shoulder contains manicured grass and the occasional paved driveway (Figure 5.3). Visibility in the area was high adjacent to the roadway but low to the north and south due to the dense grass cover. The area is heavily disturbed due to the construction of the road, powerlines and associated infrastructure services (Figure 5.5 and Figure 5.7).

The southern portion of the study area contained the remains of old railway tracks and associated drainage infrastructure (Figure 5.8 and Figure 5.9). The study area extended into the paddock on the northern side of the road, due to access restrictions this portion of the study area was assessed from the road corridor.

No Aboriginal objects or areas of potential archaeological deposit were identified within SU1.

Figure 5.2: View north east along the road corridor, SU1 (Photographed by A Darby, 25 September 2018)



Figure 5.3: View south west along the road corridor, SU1 (Photographed by A Darby, 25 September 2018)



Figure 5.4: View north west of SU1 (Photographed by A Darby, 25 September 2018)



Figure 5.5: Ground cover in SU1 (Photographed by A Darby, 25 September 2018)



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Figure 5.6: View south west along the road corridor showing driveways and services (Photographed by A Darby, 25 September 2018)



Figure 5.7: View north east along the road corridor showing services (Photographed by A Darby, 25 September 2018)



Figure 5.8: View south east of the old railway tracks (Photographed by A Darby, 25 September 2018)



Figure 5.9: View north east of the old railway tracks and concrete drainage (Photographed by A Darby, 25 September 2018)



5.4.2 Survey unit two

Survey unit two (SU2) consists of approximately 500 m of Links Road and extends approximately 13˚m into the Dunheved Golf Course (Figure 5.2).

The landscape within SU2 is predominantly flat with a slight gradient towards South Creek in the east. The roadway has been cut into the landscape, the eastern side containing a slope that has been cut into during the construction of the railway.

Vegetation in the survey unit has mostly been cleared of native vegetation, except for a few mature gum trees on the eastern side of the road and a line of poplar trees associated with the golf course on the western side. The flat areas on either side of the road contained mown grass while the slope and the old railway corridor contained dense blackberry bushes.

Visibility in the area was high on the exposed sides of the slope and along the roadway but low for the remined of the survey unit due to the dense grass cover and blackberry bushes. The area is heavily disturbed due to the construction of the road, railway line, a drainage line and associated infrastructure services.

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No Aboriginal objects or areas of potential archaeological deposit were identified within SU2.

Figure 5.10: View north west beginning of survey unit two (Photographed by A Darby, 25 September 2018)



Figure 5.11: View north showing blackberry bushes and alignment of an old railway alignment (Photographed by A Darby, 25 September 2018)



Figure 5.12: View south east beginning of survey unit two (Photographed by A Darby, 25 September 2018)



Figure 5.13: View east showing mature native trees (Photographed by A Darby, 25 September 2018)



Figure 5.14: View south east of survey unit two (Photographed by A Darby, 25 September 2018)



Figure 5.15: View north of the exposed slope (Photographed by A Darby, 25 September 2018)



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Figure 5.16: View north west showing Poplar trees and a drainage line cut into the easement (Photographed by A Darby, 25 September 2018)



Figure 5.17: Ground cover on the flat roadway (Photographed by A Darby, 25 September 2018)



Figure 5.18: Ground cover on the crest of the hill in the depression made of the railway tracks (Photographed by A Darby, 25 September 2018)



5.4.1 Survey unit three

Survey unit three (SU3) consists of the land between Christie Street and Links Road.

The landscape within SU3 has been heavily modified due to the construction of the railway and associated infrastructure. In the north east of SU3 an unsealed track continues along the same alignment of the railway line as evidenced by the remains of the ballast. The steep slopes that line the track and the centre of the survey unit are a result of being cut into.

In the centre of SU3 the landscape opens up to an artificial flat that with a degraded cement surface and imported gravels, artificial drains capped with cement transect the survey unit surrounded by rushes. Disused railway tracks and large piles of railway sleepers were observed. Vegetation in the area consists of a juvenile ironbark woodland and dense understory of tall grasses, shrubs and blackberry bushes. Visibility in the area was high along the track and exposures but low throughout the remainder. The area is heavily disturbed due to the construction of the railway line, road and earth moving practises.

No Aboriginal objects or areas of potential archaeological deposit were identified within SU3.

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Figure 5.19: View east of unsealed track (Photographed by A Darby, 25 September 2018)



Figure 5.20: View south east showing ironbark woodland and steep slope (Photographed by A Darby, 25 September 2018)



Figure 5.21: View west of the vegetation in survey unit three (Photographed by A Darby, 25 September 2018)



Figure 5.22: View east of the western portion of survey unit three (Photographed by A Darby, 25 September 2018)



Figure 5.23: View east of the vegetation in survey unit three (Photographed by A Darby, 25 September 2018)



Figure 5.24: View east of the concrete capped drain (Photographed by A Darby, 25 September 2018)



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Figure 5.25: View north east of the vegetation and disturbance (Photographed by A Darby, 25 September 2018)



Figure 5.26: View east of survey unit three (Photographed by A Darby, 25 September 2018)



Figure 5.27: View north east of the old railway tracks (Photographed by A Darby, 25 September 2018)



Figure 5.28: Ground cover in the western portion of survey unit three (Photographed by A Darby, 25 September 2018)



5.4.2 Survey unit four

Survey unit four (SU4) consists of a 100 m section of Lee Holms Drive from the Christie Street junction and from 69 to 49 Christie Street.

The landscape within SU4 is predominantly comprised of a flat landscape. The roadway has been cut into the landscape, with both sides containing curbing, manicured grass and paved driveways from the adjacent business (Figure 5.29 and Figure 5.30).

Vegetation either side of the road consists of dense grass and isolated native trees (Figure 5.31 and Figure 5.32). The northern side of the road in the east portion of SU4 contains a juvenile woodland that has been heavily disturbed (Figure 5.33). Visibility in the area was high adjacent to the roadway in the eastern proportion but low to the north and south due to the dense grass cover (Figure 5.34). The area is heavily disturbed due to the construction of the road, powerlines pedestrian walkway and associated infrastructure services (Figure 5.35 and Figure 5.36).

No Aboriginal objects or areas of potential archaeological deposit were identified within SU4.

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Figure 5.29: View west along Christie street from the road junction (Photographed by A Darby, 25 September 2018)



Figure 5.30: View east along Christie Street (Photographed by A Darby, 25 September 2018)



Figure 5.31: View south along (Photographed by A Darby, 25 September 2018)



Figure 5.32: View north of the Christie St and Lee Holm Rd junction (Photographed by A Darby, 25 September 2018)



Figure 5.33: View north of woodland (Photographed by A Darby, 25 September 2018)



Figure 5.34: Ground cover in survey unit three (Photographed by A Darby, 25 September 2018)



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Figure 5.35: View north west showing disturbance and services (Photographed by A Darby, 25 September 2018)



Figure 5.36: View south showing disturbance (Photographed by A Darby, 25 September 2018)



5.4.3 Survey coverage

A summary of survey coverage, in accordance with the Code of Practise, is provided in Table 5.1 and Table 5.2 below.

The existing bitumen road surface obscured the majority of the study area limiting effective survey area to the median strip on either side of the current road surface. Median strips across a large portion of survey unit two and three were obscured by dense grasses.

Table 5.1: Survey coverage summary – survey units

Survey unit	Survey unit area (m^2)	Landform	Visibility (%)	Exposure (%)	Effective coverage (m^2)	Effective coverage (%)
SU1	16 974	Flat	80	60	8147.5	48
SU2	22 864	Flat, slope, crest	40	50	22864	20
SU3	42 321	Flat, slope, crest	60	30	7617.8	18
SU4	13 079	Flat	60	30	2354.2	18

Table 5.2: Survey coverage summary – landforms

Landform	Landform area (m^2)	Area effectively surveyed ($m^{2)}$	Percentage of landform effectively surveyed (%)	Number of sites
Flat	52 222	21 933	42	0
Slope	33 999	8160	24	0
Crest	9017	902	10	0

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6.0 RESULTS AND DISCUSSION

No Aboriginal sites or areas of PAD were identified within the study area during the archaeological survey.

Portions of the study area contain low to moderately sensitive landscape features located at closest approximately 120 m to the east of South Creek The study area is also dissected by an unnamed tributary of South Creek. The remainder of the study area contains slightly undulating landforms which were not considered archaeologically sensitive due to their distance from creeks and waterways.

Visibility in the area was also a contributing factor for identifying archaeological potential as the dense vegetation, including blackberry bushes and grasses, lowered the visibility while the road pavement completely obscured the visibility. Due to limited surface visibility, assessment of areas of archaeological potential was identified using background information, predictive statements and general observations of the study area.

Areas of disturbance were most extensive within Links and Lee Holm Roads, Christie Street road corridor and the old railway corridor. Links Road and Christie Street have been in use as roadways since the 1900s and as a result have been subject to substantial disturbance during the construction and continued maintenance of the roadway and associated services. The field survey identified that the roadway was cut into the landscape as a result of which possible artefact bearing deposits would most likely have been removed. The land surrounding the road and rail corridor would also likely have been subject to extensive surface and sub-surface disturbance. Additional disturbances include the construction of footpaths, underground services, driveways and the electricity transmission infrastructure.

The remainder of the study area consists of an open paddock and the border of the Dunheved Golf Course. Additional isolated instances of disturbance away from the road and rail corridor include those associated with rural activities such as land clearance, construction of vehicle tracks and installation of underground services including gas and water pipelines and telecommunication cables.

6.1 Archaeological potential

The archaeological potential of an area is determined by its landform, its location and the level of disturbance. Certain landforms, such as gentle slopes, are conducive to Aboriginal occupation and the survivability of sub-surface archaeological deposit, while others, such as steep slopes, are not.

The location of appropriate landforms in relation to natural resources, in particular their proximity to permanent water sources, increases their archaeological potential. Correlations between increased numbers of Aboriginal sites and proximity to permanent water have been demonstrated in previous archaeological investigations of the Cumberland Plain (White and McDonald 2010). In areas where there is a high level of disturbance however, the archaeological potential is lowered. It is unlikely that surface finds in these areas are in their original context and it is unlikely that sub-surface archaeological deposits will remain intact.

The archaeological potential of an area is rated high, moderate or low, based on all of the above considerations.

- High - Intact archaeological material is likely to be found in this area.
- Moderate - Intact archaeological material may be found in this area.
- Low - It is unlikely that intact archaeological material will be found in this area.

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The archaeological potential of the study area is shown in Figure 6.1.

The overall archaeological potential of the study area has been assessed as low.

The study area is located on a flat landscape within 120 m of a permanent waterway and contains soil landscapes that are conducive to artefact bearing deposits. Previous studies and observations in the field indicate that potential artefact yielding deposits would have likely been removed by moderate to heavy disturbances documented within the study area. This assessment supports the earlier assessment made by JMCHM (2004) that the northern section of the study area within zone 3 and 4 of the Dunheved Precinct requires no further archaeological assessment.

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Figure 6.1: Level of disturbance within the study area



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7.0 SIGNIFICANCE ASSESSMENT

7.1 Significance assessment criteria

An assessment of the cultural heritage significance of an item or place is required in order to form the basis of its management. OEH (2011) provides guidelines for heritage assessment with reference to the Burra Charter (Australia ICOMOS 2013) and the Heritage Office (2001) guidelines. OEH requires consideration of the following:

- Research potential: does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state's natural and cultural history?
- Representativeness: how much variability (outside and/or inside the subject area) exists, what is already conserved, how much connectivity is there?
- Rarity: is the subject area important in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised? Is it in danger of being lost or of exceptional interest?
- Education potential: does the subject area contain teaching sites or sites that might have teaching potential?

It is important to note that heritage significance is a dynamic value.

7.2 Archaeological significance assessment

The survey did not result in the identification of any Aboriginal sites or areas of PAD. The study area is of low archaeological significance.

Unexpected Aboriginal archaeological material may be present within disturbed contexts. Any Aboriginal objects retrieved from these layers would likely be assessed as holding low scientific significance due to a lack of archaeological context and integrity.

7.3 Cultural significance

Mr Steve Randall (Deerubbin LALC) did not make any comments with regard to cultural sensitivity of the study area but noted that the area was heavily disturbed. At the time of production of this assessment no report has been provided by the Deerubbin LALC. It must be noted that previous archaeological and cultural assessments have noted the high cultural significance of the South Creek and its surrounds.

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8.0 MANAGEMENT AND MITIGATION MEASURES

8.1 Guiding principles

The overall guiding principle for cultural heritage management is that where possible Aboriginal sites should be conserved. If conservation is not practicable, measures should be taken to mitigate impacts to Aboriginal sites. The nature of the mitigation measures recommended is based on the assessed significance of the sites, existing permits across the study area and the impact assessment.

There are no Aboriginal sites or areas of potential archaeological deposit identified in the study area. Unexpected finds during works, including the discovery of Aboriginal ancestral remains must be managed according to the measures below:

8.2 Unexpected finds

Works can proceed with caution, without further archaeological investigation. However, an unexpected finds policy must be implemented in the event of Aboriginal archaeological deposits being identified during ground disturbing works.

An unexpected finds policy would involve the following actions:

- Stop work within the affected area, protect the potential archaeological find, and inform environment staff or supervisor.
- Contact a suitable qualified archaeologist to assess the potential archaeological find.
- If Aboriginal archaeological material is identified, works in the affected area should cease, and the OEH must be informed. Further archaeological mitigation may be required prior to works recommencing.

8.3 Aboriginal ancestral remains

In all cases, the special importance of Aboriginal ancestral remains must be acknowledged and respected and the wishes of the Aboriginal community must be respected when making decisions regarding ancestral remains.

To avoid doubt, the precautionary principle must be applied to all physical remains suspected to be Aboriginal ancestral remains.

If any human remains are disturbed in, on or under the land, you must:

- not further disturb or move these remains
- immediately cease all work at the particular location
- notify NSW Police
- notify OEH Environment Line on 131 555 as soon as practicable and provide available details of the remains and their location

  not recommence any work at the particular location unless authorised in writing by OEH. An Aboriginal community representative must be present where it is reasonably suspected that burials or human remains may be encountered. If human remains are unexpectedly encountered

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and they are thought to be Aboriginal, the Aboriginal community must be notified immediately. Recording of Aboriginal ancestral remains must be undertaken by, or be conducted under the direct supervision of, a specialist physical anthropologist or other suitably qualified person.

- Archaeological reporting of Aboriginal ancestral remains must be undertaken by, or reviewed by, a specialist physical anthropologist or other suitably qualified person, with the intent of using respectful and appropriate language and treating the ancestral remains as the remains of Aboriginal people rather than as scientific specimens.

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9.0 RECOMMENDATIONS

The following recommendations regarding Aboriginal heritage are based on consideration of:

- Statutory requirements under the *National Parks and Wildlife Act 1974*
- The requirements of the relevant guidelines: Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011), Code of practice for archaeological investigation of Aboriginal objects in New South Wales (DECCW 2010) and the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW 2010c)
- The results of the background research, archaeological survey and archaeological sensitivity assessment
- The likely impacts of the proposed development.

It was found that:

- No Aboriginal archaeological sites or areas of PAD are located within the study area

The following recommendations are made:

- Any changes to the scope of the proposal, such as a change in impact footprint, may require further archaeological survey and reporting.
- No Aboriginal objects have been identified within the study area. Works can proceed with caution, without further archaeological investigation. If unforeseen Aboriginal objects are uncovered during construction, work should cease, and an archaeologist, OEH and the Deerubbin LALC must be informed.
- If suspected human remains are located during any stage of the proposed works, work must stop immediately, and the NSW Police must be notified. OEH must be notified if the remains are found to be Aboriginal ancestral remains.

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APPENDIX 1 – EXTENSIVE AHIMS SEARCH

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artefact

Artefact Heritage
ABN 73 144 973 526
Level 4, Building B
35 Saunders Street
Pyrmont NSW 2009
Australia
+61 2 9518 8411
office@artefact.net.au
www.artefact.net.au

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APPENDIX F

ENVIRONMENTAL SITE ASSESSMENT

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Maryland Development Company Pty Ltd

Environmental Site Assessment

Links Road Extension
Dunheved, NSW

28 March 2018

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Maryland Development Company Pty Ltd
Environmental Site Assessment

Links Road Extension
Dunheved, NSW

28 March 20188

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Abbreviations

Term	Definition
ACM	Asbestos Containing Material
AF/FA	Asbestos Fines / Fibrous Asbestos
Bgs	Below Ground Surface
BTEX	Benzene, toluene, ethylbenzene and xylenes
B(a)P	Benzo(a)pyrene
DECCW	NSW Department of Environment, Climate Change and Water
DP	Deposited Plan
DQIs	Data Quality Indicators
DQOs	Data Quality Objectives
EIL/ESL	Ecological Investigation/Screening Levels
EPA	NSW Environmental Protection Authority
ESA	Environmental Site Assessment
HIL/HSL	Health Investigation/Screening Levels
LEP	Local Environmental Plan
LOR	Limit of Reporting
OCPs	Organochlorine pesticide
OEH	NSW Office of Environment and Heritage (includes EPA)
NOW	NSW Office of Water (formerly Department of Water and Energy, DWE)
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PID	Photo-ionisation Detector
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percentage Difference
SEPP	State Environmental Planning Policy
TRH	Total Recoverable Hydrocarbons
TCLP	Toxicity characteristic leaching procedure
VOCs	Volatile organic compounds

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Executive Summary

JBS&G Australia Pty Ltd (JBS&G) was engaged by Maryland Development Company Pty Ltd (the client, MDC) to conduct a Detailed Site Investigation (DSI) along a portion of Links Road and the proposed Links Road extension upgrade site area, St Marys, NSW (the site, **Figure 1**).

The northern and central sections of the site currently consisted of an asphalt sealed road (Links Road) with an unsealed road verge. The southern portion of the site currently comprises of overgrown unsealed track which is proposed to link the current Links Road with Christie Street further to the south. The site is legally defined by the coordinates on **Figure 2**, and is referred to as the 'Site 7 - Links Road and Links Road Extension Upgrade'.

It is understood that the client is completing a road upgrade and requires a DSI of the site area to determine if the site is suitable in its current state, or can be made suitable, for use as a road. Additionally, what the waste classification of any excess soil requiring offsite disposal may be.

The following DSI has been completed in general accordance with guidelines made or approved by the NSW Environment Protection Authority (EPA) and relevant Australian Standards.

fill materials were noted across the site from the surface, 0.0 m bgs to a maximum depth of 0.8 m bgs. Fill material generally comprised of light brown, silty gravelly clay soil with inclusions of shale, igneous gravels and occasional inclusions of bituminous material and concrete fragments. The inclusions were not considered to be present in such quantities as to pose an aesthetic issue. No visible ACM, odours or staining were noted within the testpits.

Natural soils were encountered at depths ranging from 0.1 m to 0.8 m bgs at the site and generally comprised of red/brown to grey mottled silty clay of medium plasticity.

A number of stockpiles and 'soil mounds' were identified during the site inspection as well as 'Flytipped' stockpiles 01 to 07 comprised of dumped rubbish including mattresses, tyres, general household rubbish, cans, bottles, and building waste such as pvc pipes and ACM sheeting. ACM fragments and sheeting were additionally observed at a number of locations on the ground surface within the site particularly in the southern portion of the site. Dark staining was observed on the ground surface adjacent the road in the central portion of the site.

Soil analytical results were compared against health based investigation levels (HIL) for commercial Industrial land use as well as ecological investigation levels (EILs) for commercial and industrial use and ecological screening levels (ESLs) for hydrocarbons in fine grained soils for commercial and industrial land use.

Soil samples were analysed for heavy metals, total recoverable hydrocarbons (TRH) benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), organochloride pesticides (OCPs) polychlorinated biphenyl (PCBs) and asbestos. As discussed in **Sections 8.2** and **9.1**, on statistical analysis of the constituent datasets and comparison to health and ecological assessment criteria which are either conservative and generic, or based on consideration of site specific factors, the most recent basis for the derivation of ecological criteria have not identified any exceedances.

No odours were observed at the site during the site works program however a single stained area was observed in the central portion of the site. However, within the context of the use of the site as a roadway, and the staining being visibly consistent with a spillage of soils / fuels, this is not considered to a significant aesthetic impact.

No asbestos was observed within the soil sampling locations however surface debris including asbestos sheeting was observed within the site.

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It is considered that the site is free of any contamination that may represent an unacceptable health risk for the proposed road use, with the exception of the surface asbestos impact. This is restricted to the site surface and is associated with materials that have been historically dumped at the surface. This is not present as contamination to soils, but wastes placed overlying soils.

Surface clean-up works, consistent with demolition/removal works, are required to remove the asbestos sheeting and other wastes / rubbish as present across the site. It is therefore considered that a management strategy, within the context of contaminated soil, is not required. A site clean up to remove surface dumped materials is required, which is outside the scope of this document, and the relevant guidelines as referred to in the creation of this document

Based on the findings of this investigation and subject to the limitations in **Section 11**, the site has been found suitable from a contamination assessment perspective for a future use to be developed as a roadway. Remedial works are not required for soil within the extent of the site to facilitate the proposed use as a roadway.

Not strictly within the scope of this assessment, but it is recommended that a surface clean up is undertaken to remove historically dumped debris from across the site, inclusive of observed asbestos containing material.

Surplus soils as generated by the site works would be classified as 'General Solid Waste' as per EPA (2014).

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1. Introduction and Background

1.1 Background

JBS&G Australia Pty Ltd (JBS&G) was engaged by Maryland Development Company Pty Ltd (the client, MDC) to conduct a Detailed Site Investigation (DSI) along a portion of Links Road and the proposed Links Road extension upgrade site area at the Maryland St Marys, NSW development site. The site, as best shown on **Figure 1**, consists of the extent of the proposed roadway.

The northern and central portions of the site currently consist of an asphalt sealed road (Links Road) with an unsealed road verge. The southern portion of the site comprises of overgrown unsealed track which is proposed to link the current Links Road with Christie Street further to the south. The site is legally defined by the coordinates on **Figure 2**, and is referred to as the 'Site 7 - Links Road and Links Road Extension Upgrade'.

It is understood that the client is completing a road upgrade and the DSI of the site area is required to determine:

- If the site is suitable in its current state, or can be made suitable, for use as a roadway from a contamination perspective; and
- Determine a waste classification to be applied to any surplus soil which is unable to be reused within the overall site and otherwise requires offsite disposal.

The following DSI has been completed in general accordance with guidelines made or approved by the NSW Environment Protection Authority (EPA) and relevant Australian Standards.

1.2 Objectives

The objectives of the investigation were to determine if the site is suitable in its current state, or can be made suitable, for use as a road. Additionally, what the waste classification of any excess soil requiring offsite disposal may be.

It is a further objective of JBS&G that we conduct the works to a high standard and in a timely fashion to enable resulting development works to progress. Our in-house NSW EPA accredited Site Auditor will have direct input into the project.

1.3 Scope of Work

The agreed scope of work comprised:

- Review of historical aerial photographs;
- Review of records of environmental incidents or former environmental licences, and contaminated land notices, as may be held by the EPA;
- Review of licensed groundwater bores near the site available online from the NSW Office of Water;
- Review of the environmental setting of the site and surrounding area including topography, geology, hydrogeology and acid sulphate soil risk maps;
- A detailed site inspection of the site and surrounding area;
- Soil sampling in accordance with the Sampling Design Guidelines (EPA 1995);
- Analysis of selected soil samples for COPC; and
- Preparation of a Detailed Site Investigation Report.

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2. Site Condition and Surrounding Environment

2.1 Site Identification

The location of the site is shown in **Figure 1**, the site details are summarised in **Table 2.1** below.

Table 2.1 Summary Site Details

Lot Number	Road Corridor
Street Address	Links Road Extension – Dunheved, St Mary's, NSW (see **Figure 2**).
Site Area	Approximately 29,000 m^3
Local Government Authority	Penrith City Council
Geographic Coordinates (MGA 56)	33.44 Latitude 150.45 Longitude
Current Land-use **Proposed Land-use**	Road Corridor and old rail passage Commercial Industrial

2.2 Site Description

To aid in the site description, the site has been divided into three portions, northern, central and southern as shown on **Figure 2**. A photographic log is provided as **Appendix A**.

The Northern portion of the site consists of a dual lane bitumen road with a concrete gutter on the southern side of the road and no gutter on the northern side of the road (see photographs 1 and 2, **Appendix A**). A number of sub-surface services were present parallel to the road within the southern verge, limiting access to sub-surface samples in this area of the site (see photograph 1 and 2, **Appendix A**). The verge on the northern side was covered in road base material and was observed to be used as a truck parking and turning area (see Photograph 3, **Appendix A**). General rubbish (cardboard and paper) was observed to have been scattered within the long grass along the southern side of the road (see photograph 4, **Appendix A**).

The Central portion of the site consisted of a single lane bitumen road. The road verge on the western side backed onto the Dunheved Golf course, while the eastern verge ran adjacent to the former rail line with the Dunheved Industrial estate beyond (see photographs 5 to 7, **Appendix A**). A number of fly tipped stockpiles (referred to as SP04, 05, 06 and 07) were observed along the eastern side of the road with material descriptions provided in **Table 2.2** below (see photograph 8-12, **Appendix A**). Additionally, several fragments of ACM and an area of dark staining were observed on the eastern side of the road as shown on **Figure 3** (see photographs 10, **Appendix A**).

The Southern portion of the site ran off the existing Links Road line and along a blocked off access track (see photographs 13 to 28, **Appendix A**). The track contained significant amounts of fly tipped materials (inclusive of SP01 to SP03) and household waste (lounges, mattresses, television). Materials included rubbish, soils, demo waste, railway sleepers and suspected asbestos containing materials. The track was covered with rail ballast and overgrown in sections with long grass and blackberry bushes which potentially concealed further dumped materials. Two large soil mounds (Soil Mound 01 and Soil Mound 02) were observed running along the southern and northern sides of the track respectively, as shown on **Figures 2** and **3.** As the track ran further south, adjoining the intersection of Lee Holm Road and Christie Street, the narrow track opened to a cleared area where a large (approximately 2000 m^3) stockpile of timber railway sleepers was located as well as a demountable building, a concrete stockpile and substantial amounts of general waste. Additionally, suspected fragments of asbestos containing material were observed at the locations detailed on **Figure 3**.

Material descriptions for both the fly tipped materials and the soil mounds are provided in **Table 2.2** below.

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Table 2.2 On Site Stockpile Details

Area ID	Approximate Volume[1]	Material Description[2]
Fly Tipped SP01 (stockpile)	60 m^3	Silty sandy CLAY – loose, non-plastic, soft, brown, heterogeneous, dry with little inclusions of plastic metal and concrete
Fly Tipped SP02 (stockpile)	10 m^3	Silty sandy CLAY – course, loose, non-plastic, soft, brown, heterogeneous, dry with little inclusions of plastic metal and concrete
Fly Tipped SP03 (stockpile)	50 m^3	CLAY – loose, non-plastic, firm, brown, heterogeneous, damp and suspected ACM found approximately 20g
Fly Tipped SP04 (stockpile)	10 m^3	Aggregate – well graded, coarse gravel, loose, heterogeneous and dry
Fly Tipped SP05 (stockpile)	15 m^3	Brick and building material no fines
Fly Tipped SP06 (stockpile)	10 m^3	Silty CLAY – loose, non-plastic, dry with household rubbish and tiles
Fly Tipped SP07 (stockpile)	5 m^3	Clayey SAND- course, loose, non-plastic, grey, heterogeneous, dry with recycled aggregates
Soil Mound 01 (Testpit logs SP01-TP01 and TP02)	800 m^3	Reworked natural – Gravelly clay, loose, medium plasticity, firm, brown orange mottles and heterogeneous.
Soil Mound 02 (Testpit logs SP02-TP01 and TP02)	2000 m^3	Reworked natural – Gravelly clay, loose, medium plasticity, firm, brown orange mottles and heterogeneous.
ACM 01 (surface)	7m x 45 m	Bonded ACM fragments on ground surface
ACM 02 (stockpile)	10 m^3	Bonded ACM sheeting in a small pile on the surface, has been spread via traffic movements
ACM 03 (stockpile)	15 m^3	Bonded ACM sheeting in a small stockpile on the surface
ACM 04 (stockpile)	10 m^3	Bonded ACM sheeting in small stockpile on the surface,
ACM 05 (stockpile)	8 m^3	Bonded ACM sheeting in a small stockpile on the surface,
ACM 06 (stockpile)	5 m^3	Bonded ACM sheeting in a small stockpile on the surface,
ACM 07 (stockpile)	7 m^3	Bonded ACM sheeting in a small stockpile on the surface within a drainage line
ACM 08 (stockpile)	5 m^3	Bonded ACM sheeting in a small spread pile on the surface of stockpile 1, with general rubbish also blended through.
ACM 09 (surface)	10 x 2 m	Bonded ACM fragments on ground surface

- [1]It is noted that although approximate volumes have been provided in **Table 2.2** above, it is recommended that a survey of the materials, particularly soil mounds 01 and 02, be undertaken if volumes are required for planning purposes.
- [2]It is further noted that additional fly tipped material is anticipated, particularly in the Southern portion of the site beneath the dense vegetation.

2.3 Surrounding Land Use

The surrounding landuses within the Links Road upgrade site are summarised below:

- North and East – A number of industrial warehouses are located to the north of the site within the Dunheved Industrial Estate.
- South – Further industrial warehouses, including Kennards Self Storage, are located to the south of the site.
- West – The Dunheved Golf Club and Course is located to the west of the site with South Creek beyond.

2.4 Topography and Hydrology

The site generally lies between 20 and 25 m AHD according to Nearmap[1]. The lightly vegetated land, industrial areas and golf course surrounding the site were approximately level with the site with a slight decline towards the Golf Course.

It is expected that runoff on the site currently drains towards golf course and low laying drainage areas surrounding the site. Excess runoff is also expected to pool within low lying areas adjacent to the road and flow towards a tributary of South Creek.

[1] http://au.nearmap.com/ accessed 16/02/2018

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2.5 Geology

Review of the 1:100 000 'Penrith' Geological Series 9030 (1991) (DMR 1997) indicated that the site is underlain by Tertiary Londonderry Clay. The Londonderry Clay is characterised by clay, patches of ferruginised, consolidated sand.

Review of the regional soil map (DLWC 1972) indicated that the site lies within the Berkshire Park soil landscape group.

The typical Berkshire landscape is characterised by weakly pedal orange heavy clays and clayey sands, often mottled with inclusions of ironstone nodules. Large silcrete boulders (up to 20cm) occur in sand/clay matrix. Yellow podzolic soils where drainage conditions are poor, red podzolic soils and chocolate soils on flats and in small drainage lines. Kransnozems are present in unstructured plastic clays and in drainage lines or a crest.

Limitations of the Berkshire landscape group are very high wind erosion hazard if cleared. Gully, sheet and rill erosion on dissected areas. Waterlogging, impermeable subsoils, low fertility hazard.

This area is largely Quaternary age alluvium beds that consist of gravelly sand, sand, clayey sand silty clay, from 1 to 8 m in depth. The soil type is the Berkshire Park soil, overlying the Bringelly Shale Unit. The Bringelly Shale unit consisting mainly of grey hard shales within intervening siltstone forms the bedrock. The top of the shale, up to 5 m thick, is highly weathered and very friable in nature. The Quaternary Alluvium comprises predominately buff coloured silt, silty/sandy clays which is often lateritic in nature and mottled with yellow/red ochres and iron nodules. Quaternary Alluvium was deposited mainly in the nearby flood plains of South Creek and Ropes Creek. Thickness of the alluvium within the site is likely to range in thickness from approximately 6m to 10m.

2.6 Hydrogeology

A review of information obtained from the Natural Resource Atlas database (DECCW 2012[2]) indicated there were seventeen registered groundwater monitoring wells in the vicinity of the site, two to the north of the site (GW111463 and GW111462), five to the south east of the site (GW109588, GW109587, GW109586, GW109584 and GW109585) and ten to the south of the site (GW113135, GW113134, GW113136, GW113127, GW113128, GW113129, GW113130, GW113132, GW113131 and GW113133).

The three registered monitoring wells to the north of the site indicated groundwater was observed at approximately 4.5 to 8.4 m bgs within the weathered shale.

The five registered groundwater monitoring wells to the south east of the site did not provide any details on the water bearing zones for these wells. However, based on the well depth of the five wells (i.e. 8.2 m bgs) it is deducted that groundwater was encountered at depths of less than 8.2 m bgs.

No details were provided on the water bearing zones for the ten registered groundwater monitoring wells installed to the south of the site.

Registered groundwater monitoring well details are provided in **Appendix B**.

2.7 Acid Sulphate Soils

Review of the Natural Resource Atlas (DNR website[3]) indicated that there no known occurrence of acid sulfate soils in the vicinity of the site.

[2] NSW National Resource Atlas, http://nratlas.nsw.gov.au/wmc/custom/homepage/index.html, Department of Environment and Climate Change, accessed 14/3/2016 (DECCW 2014)

[3] Department of Natural Resources Atlas, www.nratlas.nsw.go.au accessed 15/3/2018

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3. Site History

3.1 Aerial Photograph Review

Aerial photographs from 1947, 1955, 1965, 1975, 1982, 1994, 2002, 2009, 2012 and 2017 were obtained from the NSW Department of Finance, Services and Innovation. The aerial photograph review identified the following features in relation to the history of the site:

- In 1947 the central sections of the site comprised an unpaved road and grassed verge. The northern portion generally comprised vacant grassland with small access tracks/roads traversing the site area. The southern portion of the site crossed the railway line and a small area of bushland. The surrounding site area to the west of the site generally comprised vacant rural land with sparse trees and South Creek winding north. To the east of the site, a number of warehouses and magazine huts and associated roadways, were located across the area now known as the Dunheved Industrial Estate.
- In 1955 the site and surrounding area appear similar to the previous aerial photograph with just the construction of Links Road in the northern portion of the site. Some additional roadways have also been constructed to the east of the site and the Dunheved Golf Course has been established to the west of the site including a small Club House.
- The quality of the 1965 aerial image is poor and doesn't cover the entire site area. The northern and central sections of the site, and the surrounding site area that is visible, appears similar to the previous aerial photograph.
- In 1975 the site appeared similar to the previous aerial photograph. Further development of the Dunheved Golf Course is visible with the construction of 'bunkers' and 'greens'. A large warehouse has been constructed to the east of the northern portion of the site as well as a number of other large warehouses within the Dunheved Industrial Estate. These have replaced the smaller warehouses visible in the earlier aerial photographs. The magazine huts are still located to the east of the northern section of the site.
- In 1982 the site and surrounding area appear similar to the previous aerial photograph with just the addition of a large car park and additional buildings associated with the Dunheved Golf Course Club House as well as the planting of a number of small trees between the golf course and the central section of the site.
- In 1991 the site and surrounding area appear similar to the previous aerial photograph.
- In 2002 the site and surrounding areas appear similar to the previous aerial photograph with just the addition of a large rectangular warehouse and the removal of a square warehouse both within the Dunheved Industrial Estate to the east of the central section of the site.
- In 2009 the site and surrounding areas appear similar to the previous aerial photograph with just an additional warehouse constructed just to the east of the central section of the house, adjacent the long rectangular warehouse observed in the previous aerial photograph.
- In 2012 the site and surrounding areas appear similar to the previous aerial photograph.
- In 2017 the site and surrounding areas appear similar to the previous aerial photograph.

Aerial photographs are provided in **Appendix C**.

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3.2 EPA Records

A search of the EPA's public register under the *Protection of the Environment Operations Act 1997* was undertaken (**Appendix D**). The search identified, for the site, there were:

- No prevention, clean-up or prohibition notices; and
- No transfer, variation, suspension, surrender or revocation of an environment protection licence.

A search was also undertaken of the EPA's public contaminated land register. The search identified that there have been no notices issued under the *Contaminated Land Management Act 1997* (CLM Act) for the site.

A copy of the records is provided in **Appendix D**.

3.3 Heritage

A search of the Australian Heritage Trust database and the NSW Heritage Inventory did not reveal any heritage listed items at the site or on immediately adjoining properties. Heritage information covers Aboriginal as well as European heritage and is included in **Appendix D**.

3.4 Previous Environmental Reports

JBS&G have not been supplied with any previous environmental reports relevant to the current site area.

3.5 Integrity Assessment

The information obtained from the historical sources reviewed has been found to be in general agreement.

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4. Conceptual Site Model

4.1 Potential Areas and Substances of Environmental Concern

Based on the history review, previous investigations in proximity of the site and field observations from the site, general areas of environmental concern have been categorised and are presented in (**Table 4.1**).

Table 4.1 Areas of Environmental Concern and Associated Contaminants of Potential Concern

Area of Environmental Concern (AEC)	Contaminants of Potential Concern (COPC)
Fill material of unknown origin underlying the site	Heavy metals*, Polycyclic aromatic hydrocarbons (PAHs), Total recoverable Hydrocarbons (TRH)/Benzene, toluene, ethylbenzene and xylenes (BTEX), Organochloride Pesticides (OCPs), Polychlorinated Biphenyl (PCBs) and asbestos
Former use of the site as a sealed road	Heavy metals*, PAHs, TPH/BTEX, OCPs, OPPs, PCBs and asbestos
Fly tipping/stockpiles of material on the road verge and in the southern portion of the site	Heavy metals*, PAHs, TPH/BTEX, OCPs, OPPs, PCBs and asbestos

*Heavy Metals include As (Arsenic), Cu (Copper), Cr (Chromium), Cd (Cadmium), Ni (Nickel), Pb (Lead), Zn (Zinc) and Hg (Mercury).

4.1.1 Potentially Contaminated Media

Potentially contaminated media present at the site include:

- Fill material; and
- Natural soils underlying impacted fill materials;

The source of the fill material in road footprints is unknown. Fill material across the site must therefore be considered a potentially contaminated medium.

Based on the unknown source of fill materials, vertical migration of contamination from the fill and surface soils into the underlying natural soils may have occurred. Consequently, natural soils underlying impacted fill materials have a moderate potential to be a contaminated media.

Based on review of the available groundwater information available, it is anticipated that groundwater is located at a minimum depth of 4.5 m bgs and potentially as deep as 8.4 m bgs (see **Section 2.6**. Based on the site's long history as a sealed road, and depth to groundwater (4.6 to 8.5 m bgs) it is considered unlikely that groundwater is a contaminated media, and a site-specific groundwater assessment is not considered necessary in lieu of the identification of elevated levels of contaminants in soils that may be potentially mobile.

4.1.2 Potential Exposure Pathway

Contaminants generally migrate from site via a combination of windblown dusts, rainwater infiltration, groundwater migration and surface water runoff. The potential for contaminants to migrate is a combination of:

- The nature of the contaminants (solid/liquid and mobility characteristics);
- The extent of the contaminants (isolated or widespread);
- The location of the contaminants (surface soils or at depth); and
- The site topography, geology, hydrology and hydrogeology.

The potential contaminants identified as part of the site history review and review of previous investigations are generally in a solid form (e.g. heavy metals, asbestos, etc) and there is a low potential for contaminants to have migrated via either windblown dust or surface water.

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The potential for contaminants to migrate to and via groundwater is considered low, given the absence of any significant sources of contamination at the site, its historical use as a sealed road and the general low permeability of soils in the unsaturated zone. This assessment may need to be reconsidered however where significant levels of mobile contaminants are reported in soils.

Based on the contaminants of concern identified in various media as discussed above and proposed site activities, the exposure pathways considered to be potentially complete for the site during and following development works include:

- Potential dermal and oral contact to impacted soils as present at shallow depths and/or accessible by earthworks contractors and future footpath users; and/or
- Potential oral and dermal contact to shallow groundwater as accessible by earthworks contractors during road construction works.

At this stage, it is not anticipated that any groundwater extraction will occur over the area of the site in the future.

4.1.3 Receptors

Potential receptors of environmental impact present within the site which will require to be addressed with the site remediation / management include:

- Excavation / construction / maintenance workers conducting activities at or in the vicinity of the site, who may potentially be exposed to COPCs through direct contact with impacted soils present within excavations and/or inhalation of dusts / fibres associated with impacted soils.

Given the limited cut/fill proposed at the site, there is low risk to potential receptors of environmental impact present.

4.1.4 Preferential Pathways

For the purpose of this assessment, preferential pathways have been identified as natural and/or man-made pathways that result in the preferential migration of COPCs as either liquids or gasses.

Man-made preferential pathways may be present at the site, generally associated with fill materials at near surface depths. Fill materials are anticipated to have a higher permeability than the underlying natural soil and/or bedrock.

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5. Sampling and Analysis Plan

5.1 Data Quality Objectives

Data quality objectives (DQOs) are statements that define the confidence required in conclusions drawn for data produced for a project, and which must be set to realistically define and measure the quality of data needed.

Data quality objectives (DQOs) were developed for the investigation, as discussed in the following sections.

5.1.1 State the Problem

As the site area is to be further developed into a road linking the existing Links Road and Christie Street, a Detailed Site Investigation report is required to determine if the site is suitable for use as a road from a contamination perspective.

5.1.2 Identify the Decision

Based on the decision making process for assessing urban redevelopment site detailed in DEC (2006), modified to meet the specific project objectives, the following decisions must be made:

- Are there any unacceptable risks to likely future onsite receptors from impacted soils during development?
- Are there any issues relating to local area background soil concentrations that exceed the appropriate soil criteria?
- Are there any impacts of chemical mixtures?
- Are there any aesthetic concerns in fill soils present at the site?
- Is there any evidence of, or potential for, migration of contaminants off-site?
- Is a site management strategy required?

5.1.3 Identify Inputs to the Decision

Inputs to the decisions are:

- Historical site aerials which may identify any potentially contaminating activities which may have occurred at the site;
- Environmental data as collected by sampling and analysis and site observations made during this investigation;
- Assessment criteria to be achieved on the site as based on the intended land use and project objectives, as defined by assessment criteria nominated in **Section 6**; and
- Confirmation that data generated by sampling and analysis are of an acceptable quality to allow reliable comparison to assessment criteria as undertaken by assessment of quality assurance / quality control (QA/QC) as per the data quality indicators (DQIs) established in **Section 5.1.7**.

5.1.4 Define the Study Boundaries

The study boundaries of the site are shown on **Figure 2**.

The vertical extent of the investigation was 1.8 m bgs, which was also a minimum of 0.2 m into natural soils.

Due to the project objectives, seasonality was not assessed as part of this investigation. Data was therefore representative of the timing and duration of the current investigation.

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Groundwater has not been formally sampled / analysed during this investigation consistent with the discussion in the conceptual site model and in absence of the identification of any potentially mobile soil contaminants.

5.1.5 Develop a Decision Rule

Laboratory analytical data was assessed against EPA endorsed criteria as identified in **Section 6.**

The decision rules adopted to answer the decisions identified in **Section 5.1.2** are summarised in **Table 5.1**.

Table 5.1 Summary of Decision Rules

Decision Required to be made	Decision Rule
1. Are there any unacceptable risks to likely future onsite receptors from impacted soils during development?	The nature and extent of soil impacts will be assessed, and soil analytical data will be compared against EPA endorsed criteria. Statistical analysis, discussed in **Section 5.1.6,** of the data will be undertaken, if appropriate, to facilitate the decisions. The following statistical criteria will be adopted with respect to soils: Either: the reported concentrations are all below the adopted site criteria; Or: the 95% upper confidence limit (UCL[4]) of the average concentration for each analyte must be below the adopted site criterion. If the statistical criteria stated above are satisfied, and an assessment of risk indicates no unacceptable risks, the decision is No. Otherwise, the decision is Yes.
2. Are there any issues relating to the local area background soil concentrations that exceed appropriate soil criteria?	If the 95% UCL of surface soils exceeded published background concentrations (NEPC 2013), the decision is Yes. Otherwise the decision is No.
3. Are there any chemical mixtures	Are there more than one group of contaminants present which increase the risk of harm? If there is, the decision is Yes. Otherwise, the decision is No.
4. Are there any aesthetics issues in fill soils at the site?	If there are any unacceptable odours, anthropogenic materials or staining the answer to the decision is Yes. Otherwise, the answer to the decision is No.
5. Is there any evidence of, or potential for, migration of contaminants off-site?	Are contaminants present within natural soils at concentrations exceeding EPA endorsed criteria? If yes, the answer to the decision is Yes. Otherwise, the answer to the decision is No.
6. Is a site management strategy required?	Is the answer to any of the above decisions Yes? If yes, a site management strategy will be required to be developed. If no, a site management strategy is not required.

5.1.6 Statistical Analysis

Statistical analyses of the data will be undertaken, if required, in accordance with relevant guidance documents. The following statistical criteria shall be adopted:

- The upper 95% confidence limit on the average concentration for each analyte (calculated for samples collected from consistent soil horizons, stratigraphy or material types) must be below the adopted criterion;
- No single analyte concentration shall exceed 250% of the adopted criterion; and
- The standard deviation of the results must be less than 50% of the criterion.

It is noted that if it is considered that the data set may be subject to significant reworking (i.e. mixing of soils), the exclusion of results above 250% of the criteria from the data set may not be adopted.

[4] Sampling Design Guidelines (NSW EPA, 1995).

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5.1.7 Specify Limits of Decision Error

This step is to establish the decision maker's tolerable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data. Data generated during this project must be appropriate to allow decisions to be made with confidence.

Specific limits for this project have been adopted in accordance with the appropriate guidance from the NSW EPA, NEPC (2013), appropriate indicators of data quality (DQIs used to assess QA/QC) and standard JBS&G's procedures for field sampling and handling.

To assess the usability of the data prior to making decisions, the data was assessed against pre-determined DQIs for completeness, comparability, representativeness, precision and accuracy. The acceptable limit on decision error is 95% compliance with DQIs.

The pre-determined DQIs established for the project are discussed below in relation to precision, accuracy, representativeness, comparability and completeness (PARCC parameters), and are shown in **Table 5.2**.

- Precision - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD) of duplicate samples.
- Accuracy - measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- Representativeness –expresses the degree which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy.
- Comparability - expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; ensuring analysing laboratories use consistent analysis techniques and reporting methods.
- Completeness – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study.

If any of the DQIs are not met, further assessment will be necessary to determine whether the non-conformance will significantly affect the usefulness of the data. Corrective actions may include requesting further information from samplers and/or analytical laboratories, downgrading of the quality of the data or alternatively, re-collection of the data.

Table 5.2 Summary of Quality Assurance / Quality Control Program

Data Quality Objective	Frequency	Data Quality Indicator
Precision		
Blind duplicates (intra laboratory)	1 / 20 samples	<50% RPD
Blind duplicates (inter laboratory)	1 / 20 samples	<50% RPD
Laboratory duplicates	-	<50% RPD
Accuracy		
Surrogate spikes	All organic samples	70-130%
Laboratory control samples	1 per lab batch	70-130%
Matrix spikes	1 per lab batch	70-130%

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Data Quality Objective	Frequency	Data Quality Indicator
Representativeness		
Sampling appropriate for media and analytes		-
Samples extracted and analysed within holding times.	-	organics (14 days), inorganics (6 months)
Trip spike (for volatiles)	1 per sampling event when sampling for volatile or semi-volatile COPC	70-130% recovery
Trip blank	1 per sampling event for ambient air sampling	<LOR
Rinsate	1 per sampling event where reusable sampling equipment used	<LOR
Comparability		
Standard operating procedures for sample collection & handling	All Samples	All samples
Standard analytical methods used for all analyses	All Samples	All samples
Consistent field conditions, sampling staff and laboratory analysis	All Samples	All samples
Limits of reporting appropriate and consistent	All Samples	All samples
Completeness		
Sample description and COCs completed and appropriate	All Samples	All samples
Appropriate documentation	All Samples	All samples
Satisfactory frequency and result for QC samples	All QA/QC samples	-
Data from critical samples is considered valid	-	Critical samples valid

5.1.8 Optimise the Design for Obtaining Data

Various strategies for developing a statistically based sampling plan are identified in EPA (1995[5]), including judgemental, random, systematic and stratified sampling patterns. Random sampling is not appropriate based on the areas of environmental concern identified and the site inspection. Based on the history of the site a systematic sampling program is considered the most appropriate for the current investigation. Testpit locations were placed systematically along the length of the site, with the option for additional sampling locations to be placed in areas of observed potential increased risk of contamination (e.g. stockpiles) to better identify any potential impacts.

5.2 Soil Sampling Methodology

Tespits were undertaken by JBS&G, with the aid of an excavator, along the existing road alignment (as shown on **Figures 2** and **Figure 3**). Testpits were extended through the fill material to a minimum depth of 0.2 m into natural soils.

Soil samples were collected at 0-0.15 m, 0.3 m, 0.5 m and every 0.5 m interval as a minimum. During the collection of soil samples, features such as seepage, discolouration, staining, odours and other indicators of contamination were noted. All borehole locations were recorded with a hand held trimble GPS.

Collected samples were immediately transferred to laboratory supplied sample jars and bags. The sample jars were then transferred to a chilled ice box for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form was completed and forwarded with the samples to the testing laboratory.

It is noted that not all samples collected were selected for analysis. Samples were analysed in accordance with **Table 5.3** following.

[5] *Sampling Design Guidelines*. NSW EPA. September 1995. (EPA 1995)

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5.2.1 Photo Ionisation Detector

All chemical soil samples were screened on site during works using a photo-ionisation detector (PID) to assess the presence of volatile organic compounds (VOCs) including petroleum hydrocarbons. Based upon field observations and the PID screening results, samples were analysed in accordance with the laboratory schedule as detailed in **Table 5.3** following. PID readings and calibration of the PID are included in **Appendix E**.

5.2.2 Field Descriptions

During the collection of soil samples, features such as seepage, discolouration, staining, odours and other indications of contamination (e.g. ACM, staining, odours) were noted on borelogs included in **Appendix E**.

5.2.3 Decontamination

Prior to the commencement of sampling activities, any non-disposable sampling equipment, including sampling trowel/knife were cleaned with a water/detergent spray, rinsed with water and then air dried. The equipment was then inspected to ensure that no soil, oil, debris or other contaminants were apparent on the equipment prior to the commencement of works. Sampling equipment was subsequently decontaminated using the above process between each sampling location (**Appendix E**).

5.2.4 Duplicate and Triplicate Sample Preparation

Field soil duplicate and triplicate samples were obtained during the field works. The collected samples were divided laterally into three samples with minimal disturbance to reduce the potential for loss of volatiles and placed in three clean glass jars and sample bags as appropriate. Each sample was then labelled with a primary, duplicate or triplicate sample identification before being placed in the same chilled esky for laboratory transport.

5.3 Laboratory Analysis

JBS&G contracted Eurofins | MGT (Eurofins) as the primary laboratory for all the required analyses. The secondary laboratory for these analytes was Envirolab. All laboratories are NATA accredited for the required analyses.

In addition, the laboratories were required to meet JBS&G's internal QA/QC requirements. Laboratory analysis of samples was conducted as summarised in **Table 5.3**.

Table 5.3 Sampling and Analytical Program

Investigation Area	Area (m^2)	Sample Locations	Analytes (excludes QA/QC samples)
Site Area 7 – Links Road and Links Road Extension Upgrade	29,000	40 testpit locations	Heavy Metals[1] – 50 soil samples TPH – 31 soil samples BTEX – 31 soil samples PAHs – 54 soil samples OCP/PCBs – 16 soil samples Asbestos – 53 soil samples

[1] Heavy metals analysis includes As, Cd, Cr, Cu, Pb, Ni, Hg, Zn.
[2]Explosives analysis will include but not limited to RDX, TNT, 2,4-DNT and 2,6-DNT

In addition to the above analyses, for QA/QC purposes field duplicates and triplicates were analysed at a rate of 1/20 primary samples. A trip spike and trip blank sample was submitted with each batch of soil samples submitted to the laboratory.

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6. Assessment Criteria

6.1 Regulatory Technical Guidelines

The investigation was undertaken with consideration to aspects of the following guidelines and technical documents, as relevant:

- Contaminated Sites: Sampling Design Guidelines, NSW EPA, 1995 (EPA 1995);
- Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites, NSW OEH, 2011 (OEH 2011);
- Contaminated Sites: Guidelines for the NSW Site Auditor Scheme, 3nd Edition, Environmental Protection Authority, 2017 (EPA 2017);
- National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1), National Environment Protection Council, 2013 (NEPC 2013);
- Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014, NSW EPA (EPA 2014);
- Waste Classification Guidelines, NSW EPA, November 2014 (EPA 2014).

6.2 Soil Criteria

Based on the proposed land use as a road, concentrations of contaminants in the soil were compared against published levels for commercial / industrial purposes presented in **Table 6.1** and **Table 6.2,** sourced from relevant NEPC 2013 investigation levels outlined below;

- Health based Investigation Levels (HILs) for commercial/industrial– NEPC 2013, HIL-D; and
- Ecological screening levels (ESLs) for TRH fractions, BTEX and benzo(a)pyrene in fine grained soils for commercial industrial land use.

Commercial/industrial criteria is most appropriate for use of land for roads. Works have been completed in accordance with the decision process for assessment of urban redevelopment sites (EPA 2017). Where required, results were statistically assessed in accordance with the method summarised in **Table 5.2**.

The results of asbestos observations and analysis have been initially assessed in general accordance with NEPC (2013) and WA DOH (2009) guidance. To this extent, the most generic / conservative of the potentially applicable criteria in NEPC (2013) are summarised in **Tables 6.1** and **6.2** following. Provision is made to further discuss criteria, and derive more appropriate criteria, with assessment to specific analytes as discussed further in the results.

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Table 6.1 Health Based Soil Investigation Criteria (all units in mg/kg)

	Limit of Reporting	Laboratory Method	Health Investigation/ Screening Levels Commercial Industrial HIL D
METALS			
Arsenic	2.0	ICP-AES (USEPA 200.7)	3000
Cadmium	0.4	ICP-AES (USEPA 200.7)	900
Chromium	5.0	ICP-AES (USEPA 200.7)	3600[1]
Chromium (VI)	1.0	Alkali leach colorimetric (APHA3500-Cr/USEAP3060A)	-
Copper	5	ICP-AES (USEPA 200.7)	240,000
Nickel	5.0	ICP-AES (USEPA 200.7)	6000
Lead	5.0	ICP-AES (USEPA 200.7)	1500
Zinc	5.0	ICP-AES (USEPA 200.7)	400 000
Mercury (inorganic)	0.05	Cold Vapour ASS (USEPA 7471A)	730[2]
POLYCYCLIC AROMATIC HYDROCARBONS			
Carcinogenic PAHs (as B(a)P TPE)[3]	0.05	GCMS (USEPA8270)	40
Naphthalene	0.1	GCMS (USEPA8270)	NL[6]
Total PAHs[4]	0.4	GCMS (USEPA8270)	4000
BTEX			
Benzene	1.0	Purge Trap-GCMS (USEPA8260)	4[6]
Toluene	1.0	Purge Trap-GCMS (USEPA8260)	NL[6]
Ethylbenzene	1.0	Purge Trap-GCMS (USEPA8260)	NL[6]
Total Xylenes	3.0	Purge Trap-GCMS (USEPA8260)	NL[6]
TOTAL RECOVERABLE HYDROCARBONS			
F1 C_6-C_{10}	10	TPH Purge Trap-GCMS (USEPA8260)	310[6,]
F2 >C_{10}-C_{16}	50	TPH Purge Trap-GCMS (USEPA8260)	NL[6]
F3 >C_{16}-C_{34}	100	Purge Trap-GCFID (USEPA8000)	NL[6]
F4 >C_{34}-C_{40}	100	Purge Trap-GCFID (USEPA8000)	NL[6]
ORGANOCHLORINE PESTICIDES			
DDT + DDD + DDE	0.3	GCECD (USEPA8140,8080)	3600
Aldrin + Dieldrin	0.2	GCECD (USEPA8140,8080)	45
Chlordane	0.1	GCECD (USEPA8140,8080)	530
Endosulfan	0.3	GCECD (USEPA8140,8080)	2000
Endrin	0.1	GCECD (USEPA8140,8080)	100
Heptachlor	0.1	GCECD (USEPA8140,8080)	50
HCB	0.1	GCECD (USEPA8140,8080)	80
Methoxychlor	0.1	GCECD (USEPA8140,8080)	2500
PHENOLS			
Phenol	5	Distillation-Colorimetric (APHA 5530)	40 000
PCBs			
Total PCBs	0.7	GCECD (USEPA8140,8080)	7
Asbestos			
Asbestos (<0.1 m bgs)	0.1 g/kg	PLM / Dispersion Staining	No asbestos capable of being detected via the investigation, which comprises both visual identification and sample analysis by a NATA accredited laboratory
Asbestos FA/AF (>0.1 m bgs)	0.1 g/kg	PLM / Dispersion Staining	0.001%

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	Limit of Reporting	Laboratory Method	Health Investigation/ Screening Levels Commercial Industrial HIL D
Bonded ACM (>0.1 m)	0.1 g/kg	PLM / Dispersion Staining	0.05%
Asbestos Fibres	0.1 g/kg	PLM / Dispersion Staining	No respirable asbestos fibres of being detected via sample analysis by a NATA accredited laboratory
Explosives			
RDX	0.5	HPLC (USEPA 8332)	10^7
TNT	0.5	HPLC (USEPA 8332)	15^7
2,4 – DNT and 2,6 - DNT	0.5	HPLC (USEPA 8332)	1.5^7

Notes:
1. Guideline values presented are for Chromium (VI) in absence of total Chromium values. Where total Chromium results are elevated, samples will be analysed for Chromium (VI).
2. Guideline values are for inorganic mercury. Where elevated mercury concentrations are encountered and/or site information suggests the potential presence of elemental mercury and/or methyl mercury, consideration of applicability would be needed.
3. Carcinogenic PAHs calculated as per Benzo(a)pyrene Toxicity Equivalent Factor requirements presented in NEPC 2013
4. Total PAHs calculated as per requirements presented in NEPC 2013.
6. Soil Health Screening Levels for Vapour Intrusion: Clay Soils. Values presented are those for 0 to <1 m bgs for commercial/industrial landuse. Reference should be made to results tables for further detail of levels at greater depths.
7. US Army Medical Bioengineering Research and Development Laboratory for the Corn Husker Army Ammunition Plan, Rosenblah, 1986.
NL: Non-limiting.

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Table 6.2 Ecological Screening Levels (all units in mg/kg)

	Limit of Reporting	Laboratory Method	ESLs Urban Residential and public open space	EILs NEPM 2013 - Commercial Industrial (generic)
METALS				
Arsenic	4.0	ICP-AES (USEPA 200.7)	-	160
Cadmium	0.4	ICP-AES (USEPA 200.7)	-	-
Chromium	1.0	ICP-AES (USEPA 200.7)	-	310
Chromium (VI)	1.0	Alkali leach colorimetric (APHA3500-Cr/USEAP3060A)	-	-
Copper	1.0	ICP-AES (USEPA 200.7)	-	85
Nickel	1.0	ICP-AES (USEPA 200.7)	-	55
Lead	1.0	ICP-AES (USEPA 200.7)	-	1800
Zinc	1.0	ICP-AES (USEPA 200.7)	-	110
Mercury (inorganic)	0.1	Cold Vapour ASS (USEPA 7471A)	-	-
Benzo(a)pyrene	0.5	GCMS (USEPA8270)	1.4	-
Naphthalene	0.1	GCMS (USEPA8270)	-	370
Benzene	1.0	Purge Trap-GCMS (USEPA8260)	95	-
Toluene	1.0	Purge Trap-GCMS (USEPA8260)	135	-
Ethylbenzene	1.0	Purge Trap-GCMS (USEPA8260)	185	-
Total Xylenes	3.0	Purge Trap-GCMS (USEPA8260)	95	-
F1 C_6-C_{10}	10	TPH Purge Trap-GCMS (USEPA8260)	215[1]	-
F2 >C_{10}-C_{16}	50	TPH Purge Trap-GCMS (USEPA8260)	170[2]	-
F3 >C_{16}-C_{34}	100	Purge Trap-GCFID (USEPA8000)	2500	-
F4 >C_{34}-C_{40}	100	Purge Trap-GCFID (USEPA8000)	6600	-
ORGANOCHLORINE PESTICIDES				
DDT	0.1	GCECD (USEPA8140,8080)	-	640

Notes:

Values for F1 C6-C9 are obtained by subtracting BTEX (Sum) from laboratory result for C6-C9 TRH.

Values for F2 >C10-C16 are obtained by subtracting naphthalene from laboratory result for >C10-C16 TRH.

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7. Quality Assurance/Quality Control

7.1 QA/QC Results

The QA/QC results for soil samples collected at the site are summarised in **Table 7.1** and discussed in **Section 7.2** below. Detailed QA/QC results are included in **Appendix F**. Laboratory reports are included in **Appendix G**.

Table 7.1 Summary of Quality Assurance / Quality Control Program

Data Quality Indicator	Frequency	Results	DQI met?
Precision			
Soil Blind duplicates (intra laboratory)	>1 / 20 samples	3 in 63 primary samples with RPS ranging from 0-199 %	Partial[1] Partial[1]
Soil Blind triplicates (inter laboratory)	>1 / 20 samples	2 in 63 primary samples with RPS ranging from 0-195 %	Partial[1] Partial[1]
Laboratory Duplicates	>1/lab batch	0-32 % RPD	Yes
Accuracy			
Surrogate spikes	All organic Analysis	60 – 129 % Recovery	Partial[1]
Laboratory Control Samples	>1/lab batch	72-129 % Recovery	Yes
Matrix spikes	>1/lab batch	57-133 % Recovery	Partial[1]
Representativeness			
Sampling appropriate for media and analytes	All media/Analytes	All sampling conducted in accordance with JBS&G procedures	Yes
Laboratory blanks	>1/lab batch	<LOR	Yes
Samples extracted and analysed within holding times.	N/A	All samples were extracted and analysed within holding times.	Yes
Trip spikes	1/lab batch	88-100 % Recovery	Yes
Trip blanks	1/lab batch	<LOR	Yes
Rinsate blank	1/sampling event	NA	Partial[1]
Comparability			
Standard operating procedures used for sample collection & handling	All samples	Field staff used same standard operating procedures throughout works	Yes
Standard analytical methods used	All samples	Standard analytical methods used as listed in **Table 5.1**.	Yes
Consistent field conditions, sampling staff and laboratory analysis	All samples	Sampling was conducted by the same field staff members using standard operating procedures in the same conditions throughout the works. The laboratory remained consistent throughout the investigation.	Yes
Limits of reporting appropriate and consistent	All samples	Limits of reporting were consistent and appropriate.	Yes
Completeness			
Soil description & COCs completed	All samples	All testpit logs and COCs were completed appropriately.	Yes
Appropriate documentation	All samples	All appropriate field documentation is included in the Appendices.	Yes
Satisfactory frequency/result for QA/QC samples	All samples	The QC results are considered adequate for the purposes of the investigation.	Yes
Data from critical samples is considered valid	All samples	Data from critical samples is considered valid.	Yes
Sensitivity			
Analytical methods and limits of recovery appropriate for media and the adopted site assessment criteria	All samples	Appropriate laboratory analysis methods and detection limits were considered to have been achieved during the field and laboratory phases of the investigation	Yes

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7.2 QA/QC Discussion

7.2.1 Precision

Blind (intra-laboratory) Duplicates

Soil field blind (intra-laboratory) duplicates were analysed at a rate of 3 per 63 primary samples, just below the required 1/20 DQI frequency. Although 63 primary samples were analysed, it is noted that less than 54 samples were analysed for each analyte, i.e. within the required 1/20 samples.

Field blind duplicates had relative percentage differences (RPDs) were generally within the acceptable range of less than 50% with the following exceptions:

- Heavy metals chromium and zinc between primary sample TP12_0.0-0.1 and duplicate sample QA20180202-03 with RPDs of 59% and 70% respectively;
- TRH fractions TRH C15-C28, C29-C36, C10-36, C16-C34 and C34-C40 between primary sample TP18-0.0-0.1 and duplicate sample QA20180202-01 with RPDs ranging between 57% and 174%; and
- PAH constituents (Acenaphthene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(a)pyrene TEQ, Benzo(b,j)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-c,d)pyrene, Phenanthrene, Pyrene and total PAHsl) between primary sample TP18-0.0-0.1 and duplicate sample QA20180202-01 with RPDs ranging between 75% and 199%;

The high RPDs are attributed to the heterogeneity of the material analysed and the likely inclusions of bituminous material and igneous gravels. Additionally, a number of analysis were reported near the laboratory LOR resulting in elevated RPDs even though results are similar. Therefore the exceeding RPD values are believed to be insignificant in the context of the investigation. Detailed RPD analysis are provided in **Attachment F.**

Split (inter-laboratory) Duplicates

Soil field split (inter-laboratory) duplicates were analysed at a rate of 2 per 63 primary samples below the required 1/20 DQI frequency. Although 63 primary samples were analysed, it is noted that less than 54 samples were analysed for each analyte, i.e. 2/54 or 1/27, only marginally below the required frequency and not considered to affect the reliability of the data.

All field Split duplicates had relative percentage differences (RPDs) within the acceptable range of less than 50% with the following exceptions:

- The heavy metal nickel between primary sample TP34-0.0-0.1 and triplicate sample QC20180201-01 with an RPD of 59%;
- TRH fractions TRH C15-C28, C29-C36, C16-C34 and C34-C40 between primary sample TP34-0.0-0.1 and triplicate sample QC20180201-01with RPDs ranging between 57% and 150%; and
- PAH constituents (Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(a)pyrene TEQ, Benzo(b,j)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-c,d)pyrene, naphthalene, Phenanthrene, Pyrene and total PAHsl) between primary sample TP18-0.0-0.1 and duplicate sample QA20180202-01 with RPDs ranging between 82% and 194%;

The high RPDs are attributed to the heterogeneity of the material analysed and the likely inclusions of bituminous material and igneous gravels. Additionally, a number of analysis were reported near the laboratory LOR resulting in elevated RPDs even though results are similar. Therefore the

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exceeding RPD values are believed to be insignificant in the context of the investigation. Detailed RPD analysis are provided in **Appendix F**.

Laboratory duplicates

All laboratory duplicates RPDs were within the acceptable range of less than 50%, within the JBS&G's acceptable range, and the laboratory QC Acceptance Criteria as defined in the Internal Quality Control Review.

7.2.2 Accuracy

Surrogate spikes

Surrogate spike recoveries were reported between 60% and 129%. Although some recoveries were below the JBS&G acceptable criteria (I.e. 70-130%), all the surrogate recoveries were within the laboratory acceptance criteria and as such, the data set is considered reliable and the results are not considered to affect the reliability of the results reported.

Laboratory Control Samples

Laboratory control samples were conducted for each laboratory batch submitted and were all within JBS&G's acceptance criteria of 72-129%. The data set is therefore considered to be reliable.

Matrix Spikes

Matrix spike samples were conducted for each laboratory batch submitted and were all within JBS&G's acceptance criteria of 60-133%, marginally outside of the JBS&Gs prescribed range of 70-130% however within the NATA certified laboratory range of 60-140%.

7.2.3 Representativeness

Sampling appropriate for media and analytes

The sampling methods were considered appropriate for soil media and the analytes targeted.

Laboratory Blanks

At least one laboratory blank was analysed for each analyte with each batch of samples. All levels of analytes in laboratory blanks were below detection limits.

Trip Spikes

Trip spike recoveries were between 88-100% and were all within the acceptable range of 70-130%.

Trip blanks

A trip blank was provided with each batch of samples. All levels of analytes in the trip blanks were below detection limits.

Rinsate Samples

Rinsate samples were not collected as a part of this investigation. Disposable sampling equipment such as disposable nitrile gloves were worn and samples were taken directly from the auger with care taken to sample soils that had not made contact with the auger.

Holding times

All analyses have been extracted within holding times.

7.2.4 Comparability

Common and consistent JBS&G Field Personnel were used to collect samples throughout the project. Field works have been undertaken in accordance with JBS&G field operating procedures. All required field forms and sampling logs have been appropriately completed by sampling personnel.

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7.2.5 Completeness

Documentation

All documentation was completed to the required standard. Chain of custody forms are provided with laboratory documentation included in **Appendix G**.

Frequency for QA/QC Samples

The frequency of QA/QC samples is considered to be sufficient and meets the project DQI's.

7.3 Soil QA/QC Conclusions

The results of the field and laboratory QA/QC program indicates that the data obtained from this investigation generally met the predetermined DQIs or, where the DQIs were exceeded, did not indicate systematic sampling or analytical errors. As such the data is considered to be of adequate quality to be relied on for the purposes of assessing the environmental condition at the site.

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8. Results

8.1 Field Observations

JBS&G conducted a detailed site investigation and soil sampling at the site on 1, 2 and 5 February 2018. The soil sampling locations are provided on **Figure 3** with testpit logs provided in **Appendix E**.

During the testpitting works, fill materials were noted across the site from the surface, 0.0 m bgs to a maximum depth of 0.8 m bgs. Fill material generally comprised of light brown, silty gravelly clay soil with inclusions of shale, igneous gravels and occasional inclusions of bituminous material and concrete fragments. The inclusions are not considered to be present in such quantities as to pose an aesthetic issue. No visible ACM, odours or staining were noted within the testpits.

Natural soils were encountered at depths ranging from 0.1 m to 0.8 m bgs at the site and generally comprised of red/brown to grey mottled silty clay of medium plasticity.

A number of stockpiles and 'soil mounds' were identified during the site inspection as shown on **Figures 2** and **3**. 'Flytipped' stockpiles 01 to 07 comprised of dumped rubbish including mattresses, tyres, general household rubbish, cans, bottles, and building waste such as pvc pipes and ACM sheeting.

ACM fragments and sheeting were additionally observed at a number of locations on the ground surface within the site particularly in the southern portion of the site as detailed in **Section 2.2**.

Dark staining was observed on the ground surface adjacent the road in the central portion of the site, as shown on **Figures 2** and **3**.

8.2 Analytical Results

Soil summary analytical results are provided in **Table 1** with TCLP results summarised in **Table B**. Detailed laboratory reports and chain of custody documentation is provided in **Appendix G**.

8.2.1 Heavy Metals

Concentrations of heavy metals were reported below the adopted health and ecological based criteria for all samples analysed with the exception of the following:

- Testpit sample location TP001_0.0-0.1 with a nickel and zinc concentration of 65 and 140 mg/kg exceeding the adopted ecological investigation levels of 55 and 110 mg/kg respectively;
- Testpit sample location TP02_0.0-0.1 with a zinc concentration of 230, exceeding the adopted ecological investigation level of 110 mg/kg;
- Testpit sample location TP04_0.0-0.1 with a zinc concentration of 440 mg/kg, exceeding the adopted ecological investigation level of 110 mg/kg by more than 250%;
- Testpit sample location TP06_0.0-0.1 with a zinc concentration of 170, exceeding the adopted ecological investigation level of 110 mg/kg;
- Testpit sample location TP07_0.0-0.1 with a zinc concentration of 180 mg/kg, exceeding the adopted ecological investigation level of 110 mg/kg;
- Testpit sample location TP07_0.2-0.3 with a zinc concentration of 180 mg/kg, exceeding the adopted ecological investigation level of 110 mg/kg;
- Testpit sample location TP09_0.0-0.1 with a zinc concentration of 550 mg/kg, exceeding the adopted ecological investigation level of 110 mg/kg by more than 250%;

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- Testpit sample location TP18-0.0-0.1 and the corresponding duplicate sample QA20180202-01 with a zinc concentration of 130 and 270 mg/kg respectively, both exceeding the adopted ecological investigation level of 110 mg/kg;
- Testpit sample location TP21-0.0-0.1 with a zinc concentration of 130 mg/kg, exceeding the adopted ecological investigation level of 110 mg/kg;
- Testpit sample location TP30-0.0-0.1 with a zinc concentration of 130 mg/kg, exceeding the adopted ecological investigation level of 110 mg/kg;
- Testpit sample location TP31-0.2-0.3 with a copper concentration of 86 mg/kg, exceeding the adopted ecological investigation level of 85 mg/kg;
- Testpit sample location TP34-0.0-0.1 and corresponding duplicate and triplicate samples QA20180201-01 and QC20180201-01 with a zinc concentration of 150, 210 and 110 mg/kg respectively, exceeding the adopted ecological investigation level of 110 mg/kg;
- Testpit sample location TP36-0.2-0.3 with a nickel concentration of 84 mg/kg, exceeding the adopted ecological investigation level of 55 mg/kg;
- Surface sample DS01 with a zinc concentration of 130 mg/kg, exceeding the adopted ecological investigation level of 110 mg/kg; and
- Stockpile sample location FTSP01 with a zinc concentration of 170 mg/kg, exceeding the adopted ecological investigation level of 110 mg/kg;

Further assessment of levels of heavy metals is detailed in **Section 8.3**.

8.2.2 BTEX

Concentrations of BTEX were reported below the laboratory LORs and the adopted health and ecological based criteria in all samples analysed.

8.2.3 Total Recoverable Hydrocarbons

Concentrations of TRH all with the adopted criteria with the following exceptions:

- Surface stained location DS01 with a TRH C_{10}-C_{16} concentration of 1900 mg/kg, exceeding the adopted commercial industrial management limit of 1000 mg/kg;
- Testpit sample location TP20-0.0-0.1 with a TRH C_{16}-C_{34} concentration of 3200 mg/kg, exceeding the adopted commercial industrial ESL for fine soil limit of 2500 mg/kg;
- Surface stained location DS01 with a TRH C_{16}-C_{34} concentration of 6300 mg/kg, exceeding the adopted commercial industrial management limit of 2500 mg/kg; and
- Surface stained location DS01 with a TRH C_{10}-C_{16} less Napthalene (F2) concentration of 1900 mg/kg, exceeding the adopted commercial industrial ESL for fine soils of 170 mg/kg.

Further assessment of levels of TRH has been undertaken in **Section 8.3**.

8.2.4 PAHs

Concentrations of PAHs were reported below the adopted health and ecological based criteria for all samples analysed with the exception of the following:

- Testpit sample location TP02_0.0-0.1 with a Benzo(a)pyrene concentration of 1.9 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP05_0.0-0.1 with a Benzo(a)pyrene concentration of 1.7 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;

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- Testpit sample location TP07_0.0-0.1with a Benzo(a)pyrene concentration of 2.2 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP07_0.2-0.3 with a Benzo(a)pyrene concentration of 5.3 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP08_0.0-0.1 with a Benzo(a)pyrene concentration of 1.4 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP13_0.0-0.1 with a Benzo(a)pyrene concentration of 4.3 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP14-0.0-0.1 with a Benzo(a)pyrene concentration of 39 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg and a Benzo(a)pyrene TEQ of 60 mg/kg, exceeding the adopted human health criteria of 40 mg/kg;
- Testpit sample location TP14 0.2-0.3 with a Benzo(a)pyrene concentration of 4.8 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP15-0.0-0.1 with a Benzo(a)pyrene concentration of 1.5 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP17-0.0-0.1with a Benzo(a)pyrene concentration of 9.6 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP18-0.0-0.1 with a Benzo(a)pyrene concentration of 18 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP19-0.0-0.1 with a Benzo(a)pyrene concentration of 12 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP20-0.0-0.1 with a Benzo(a)pyrene concentration of 47 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg and a Benzo(a)pyrene TEQ of 73 mg/kg, exceeding the adopted human health criteria of 40 mg/kg;
- Testpit sample location TP21-0.0-0.1 with a Benzo(a)pyrene concentration of 1.4 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP27-0-0.1 with a Benzo(a)pyrene concentration of 1.6 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP30-0.0-0.1 with a Benzo(a)pyrene concentration of 16 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location QC20180201-01, triplicate sample of primary sample TP34-0.0-0.1 with a Benzo(a)pyrene concentration of 15 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg;
- Testpit sample location TP40-0.0-0.1 with a Benzo(a)pyrene concentration of 2.7 mg/kg, exceeding the adopted ecological investigation levels of 1.4 mg/kg.

Further assessment of levels of PAHs, inclusive of benzo(a)pyrene, for ecological and health effects has been undertaken in **Section 8.3**.

8.2.5 OCPs and PCBs

Concentrations of OCPs and PCBs were reported below the adopted health based criteria for all samples analysed.

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8.2.6 Asbestos

No visible ACM was observed within any of the testpits conducted. Asbestos was observed however on the ground surface at a number of locations, as shown on **Figure 3** attached.

No AF/FA or respirable asbestos fibres were detected in soil samples submitted for laboratory analysis apart from a trace concentration of asbestos fines / friable asbestos at sample location TP14-0.0-0.1, below the adopted criteria of 0.001% w/w. Soil asbestos analytical results are summarised in **Table 1**.

The level of detected asbestos is below the NATA advised analytical detection limit for asbestos and is further well below the health-based investigation level. No further assessment and/or consideration of potential asbestos impacts within soils is required.

8.2.7 Preliminary Waste Classification

Based on the analytical data summarised in **Table 1** and **2** attached, it is considered that the in-situ materials can be classified as general solid waste for offsite disposal purposes or be reused within the road corridor in accordance with the reclaimed asphalt pavement order 2014.

The dumped materials were observed to have ACM present at several locations and would therefore require disposal offsite as special (Asbestos) waste.

8.3 Further Assessment of Generic Criteria Exceedances

Direct comparison of constituent levels to generally the most conservative of the published criteria that may be applied to the site has been undertaken through **Section 8.2**. This method of assessment, for health and ecological investigation levels, is reported to be unsuitable by NEPC (2013).

NEPC (2013) instructs assessment to investigation levels must examine a range of summary statistics including the contaminant range, median, arithmetic/geometric mean, standard deviation and 95% upper confidence limit (UCL). Further, at the very least, the maximum and the 95% UCL of the arithmetic mean contaminant concentration should be compared to the relevant Tier 1 screening criteria. However, where there is sufficient data available, and it is appropriate for the exposure being evaluated, the arithmetic mean (or geometric mean in cases where the data is log normally distributed) should also be compared to the relevant Tier 1 investigation or screening level. With respect to the assessment of maximum levels it is additionally instructed that no single value should exceed 250% of the relevant investigation or screening level.

The additional guidance for the exclusion of values more than 250% than an adopted investigation level is not considered to be appropriate for this particular assessment. This condition presumes that soils will be undisturbed form the current location, and any areas of maximums / hotspots will persist. However this will not be the case for Links Rd, with substantial earthworks required to be undertaken, to prepare the sub-surface for the roadway, which will then facilitate the potential exposure to occur. With the earthworks, the maximum levels will be caused to be redistributed through the surrounding soils.

The proposal to undertake these earthworks however further preclude the consideration of a mean concentrations to be compared to criterion. The 95% UCL_{avg} of the mean must be used so as to ensure sufficient conservatism to account for any potential redistribution of the detected contaminant levels.

8.3.1 Statistical Analysis

Statistical analysis has been undertaken using the US EPA ProUCL v5.1 package. In preparing analytical datasets for the site, all data has been included. Further in cases where duplicate samples / pairs are available, the maximum concentration across the extent of the duplicate pair has been adopted for each constituent. Results of statistical analysis for each constituent as identified in

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Section 8.2 as potentially exceeding a criterion are summarised in **Table 8.1** following. Statistical analysis outputs are provided as **Appendix H**.

Table 8.1: Summary of Statistical Analysis of Soils Dataset (mg/kg)

Constituent	95% UCL_{avg}	Mean	Maximum	Standard Deviation	Number
Copper	29	24	86	19	50
Nickel	22	17	84	17	50
Zinc	120	94	550	105	50
Benzo(a)pyrene	9.1	3.8	47	8.7	54
Benzo(a)pyrene TEQ	6.7	5.6	73	13.4	54
TRH C10-C16	408	113	1900	327	31
TRH C16-C34	730	581	6300	1236	31

The comparison of the statistically derived levels of each constituent to criterion protective of health and/or ecological effects is described in the following sections.

8.3.2 Copper Ecological Impacts

The maximum concentration of copper of 86 mg/kg exceeded the adopted ecological investigation level by 1 mg/kg only. The 95% UCL_{avg} level is well below the criterion, and there is no basis to consider that levels of copper in soils pose a potential ecological risk.

8.3.3 Nickel Ecological Impacts

Two samples were identified with levels of nickel that marginally exceeded the adopted ecological investigation level. The statistically derived 95% UCL_{avg} level is well below the adopted ecological investigation level, and on this basis nickel is not considered to pose a potential ecological risk.

8.3.4 Zinc Ecological Impacts

The 95% UCL_{avg} for zinc has marginally exceeded the adopted generic zinc ecological criterion of 110 mg/kg as provided for commercial / industrial uses. By review of NEPC (2013), a range of potential ecological criteria are provided for zinc in soils as based on consideration of soil pH and cation exchange capacity (CEC). Previous assessments in proximity of the site have identified that soils are generally a neutral pH. Assuming a minimum soil pH of 6.0, the minimum potentially applicable zinc ecological protection criterion is 360 mg/kg. The estimated 95% UCL_{avg} is well below this. There is no basis to consider that the zinc levels measured posed a potential ecological risk.

8.3.5 Benzo(a)pyrene TEQ Human Health Impacts

The 95% UCL_{avg} level of carcinogenic PAHs, assessed as benzo(a)pyrene TEQ, is well below the health-based investigation level of 40 mg/kg. On this basis, carcinogenic PAHs are not considered to pose a potential health risk.

8.3.6 Benzo(a)pyrene Ecological Impacts

NEPC (2013) recommends an ecological screening level of 0.7 mg/kg be adopted for fine and coarse soils for the assessment of potential ecological effects of benzo(a)pyrene. By review to the supporting documentation to NEPC (2013), this criterion has been based on recommendations as issued to *Review of the appropriateness of the Canadian petroleum hydrocarbon country-wide standards in soil, for incorporation into the Australian National Environment Protection (Assessment of Site Contamination) Measure, National Environment Protection Council, Australia*, 2010, Warne, MStJ (Warne 2010).

From review of Warne (2010), the review of benzo(a)pyrene ecological toxicity was based on a review of *Recommended Canadian Soil Quality Guidelines*, March 1997, Canadian Council of Ministers of the Environment (CCME 1997). A provisional soil quality guideline for ecological

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protection of 0.7 mg/kg is provided for agricultural and residential / parkland settings within CCME (2007) as based on direct contact to soils.

More recently, and importantly subsequent to the Warne (2010) review, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Polycyclic Aromatic Hydrocarbons*, 2010, Canadian Council of Ministers of the Environment (CCME 2010) has been issued and revised the guidance for the assessment of benzo(a)pyrene in soil ecological effects. The revised guidance consists of:

- A soil quality guideline for protection of ecological effects of benzo(a)pyrene in soils of 20 mg/kg provided for agricultural and residential / parkland land-uses. The guideline is based on direct contact to soils; and
- A soil quality guideline for protection of ecological effects of benzo(a)pyrene in soils of 72 mg/kg provided for commercial and industrial land-uses. The guideline is similarly based on direct contact to soils.

The maximum level of benzo(a)pyrene in site soils of 47 mg/kg is well below the more recent soil criterion for the protection of ecological impacts on a commercial / industrial site. On this basis, there is no basis to further consider the potential ecological risk posed by benzo(a)pyrene.

8.3.7 TRH C10-C16 and C16-C34 Ecological Impacts

Exceedances of ecological criteria have been observed for TRH C10-C16 and C16-C34 impacts. Noting that the site is proposed to be developed as a roadway, and roadway asphalt as will be used across the whole extent of the assessment site, there is considered little purpose to assess slightly elevated levels of TRH C10-C16 and C16-C34 constituents as are present.

These constituents are present at very high levels in roadbase / asphalt / bitumen materials. With this, with the re-paving of the road, they will be present at high levels in the materials used to pave the road. There is little purpose to assess the significance of slightly elevated levels as present in the data set, when substantially higher levels must be applied across the site to allow the proposed site use to occur.

It is finally noted that it is more than likely that the levels that have been measured are consequent of historical roadbase materials that are present across the site and have been entrained in samples.

8.3.8 Risk to Groundwater

Consistent with the discussion in the preceding Sections (**Sections 4.1.2** and **5.1.4**), it is not considered that soil contaminants have been identified of a nature and at a concentration that pose a potential risk of groundwater contamination. As based on the discussion in the CSM, there is not considered to be requirement to assess groundwater contamination.

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9. Site Characterisation

The results are discussed in the following sections in relation to the identified decisions developed as part of the DQO process (**Section 5.1.2** and **5.1.5**).

9.1 Are there any unacceptable risks to future site users or the environment from soil contamination?

Statistical analysis of constituent datasets and comparison to health and ecological assessment criteria which are either conservative and generic, or based on consideration of site specific factors and the most recent basis for the derivation of ecological criteria, have not identified any exceedances.

It is noted that this assessment has considered the historical presence of semi and non-volatile TRH constituents as present on the site are most likely associated with roadbase, and future application of roadbase with the proposed use of the site will include substantial levels of these constituents. The assessment has further considered that soils within the site will be re-worked with the proposed road construction.

9.2 Are there any issues relating to the local area background soil concentrations that exceed appropriate criteria?

Background soil samples were not collected as part of the current investigation. However, the concentrations reported in the soil samples collected from natural soils across the site are generally representative of background conditions (as reported in NEPC 2013), based on the site history and the general absence of chemical contaminants identified.

9.3 Are there any impacts of chemical mixtures?

There were no potential chemical mixtures identified during the investigation that may pose a management issue at the site.

9.4 Are there any odours or aesthetic issues?

No odours were observed at the site during the site works program.

A single stained area was observed in the central portion of the site as shown on **Figures 2** and **3**. However, within the context of the use of the site as a roadway, and the staining being visibly consistent with a spillage of soils / fuels, this is not considered to a significant aesthetic impact.

No asbestos was observed within the soil sampling locations however surface debris including asbestos sheeting was observed within the site, as discussed in **Section 8.1** above and shown on **Figure 3**.

9.5 Is there any evidence of, or potential for, migration of contaminants from the site?

There is no potential for migration of contaminants from the site as the only contamination identified at the site are associated with isolated bitumen fragments and asbestos sheeting within shallow soil and on the ground surface. Levels of other constituents were below a level that was indicative of a potential health or ecological risk.

9.6 Is a management strategy required?

Based on the decision-making process above, it is considered that the site is free of any contamination that may represent an unacceptable health risk for the proposed road use, with the exception of the surface asbestos impact. This is restricted to the site surface and is associated with materials that have been historically dumped at the surface. This is not present as contamination to soils, but wastes placed overlying soils.

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Surface clean-up works, consistent with demolition/removal works, are required to remove the asbestos sheeting and other wastes / rubbish as present across the site. It is therefore considered that a management strategy, within the context of contaminated soil, is not required. A site clean up to remove surface dumped materials is required, which is outside the scope of this document, and the relevant guidelines as referred to in the creation of this document.

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10. Conclusions and Recommendations

Based on the findings of this investigation and subject to the limitations in **Section 11**, the site has been found suitable from a contamination assessment perspective for a future use to be developed as a roadway. Remedial works are not required for soil within the extent of the site to facilitate the proposed use as a roadway.

Not strictly within the scope of this assessment, but it is recommended that a surface clean up is undertaken to remove historically dumped debris from across the site, inclusive of observed asbestos containing material.

Surplus soils as generated by the site works would be classified as 'General Solid Waste' as per EPA (2014).

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11. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquires.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

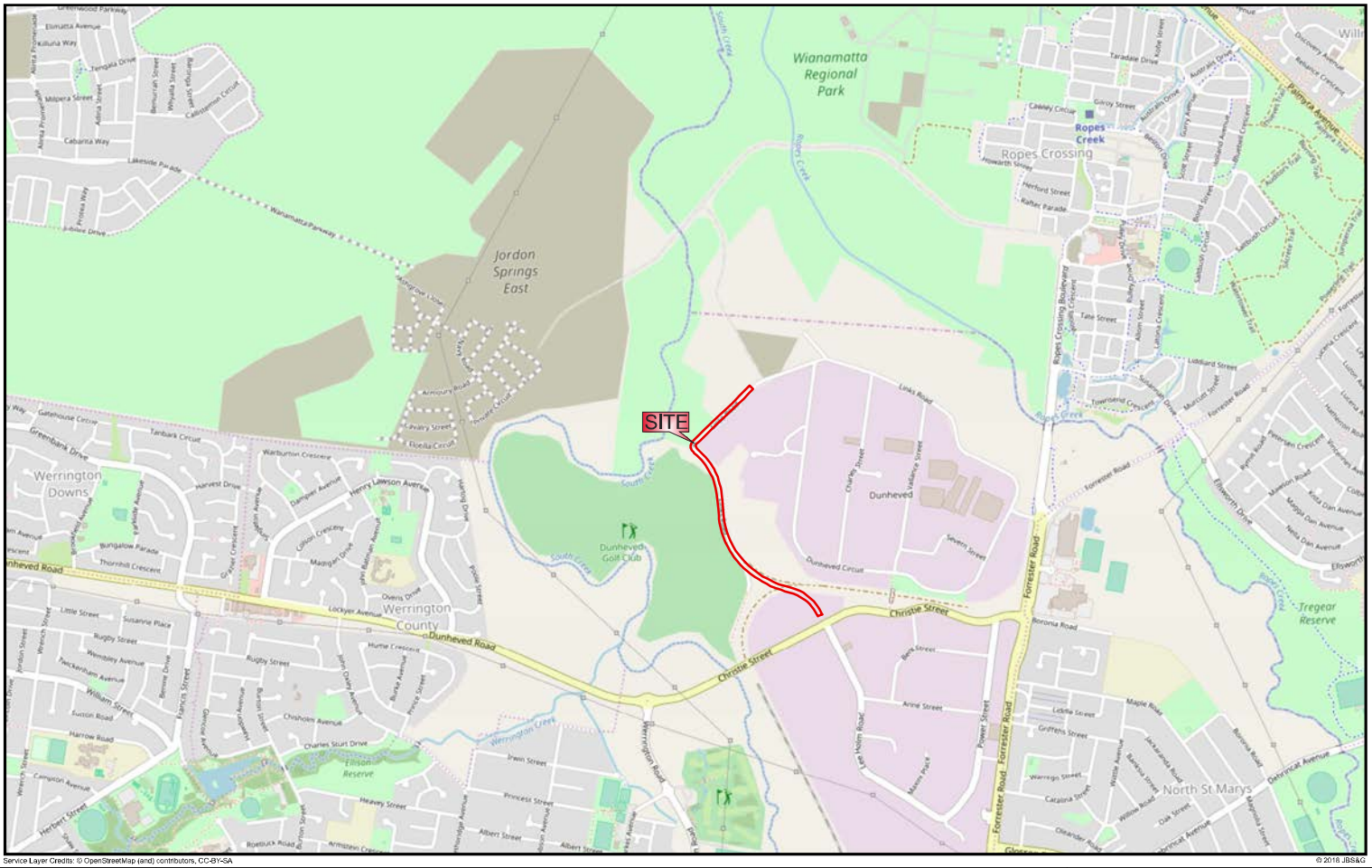
Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

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Figures

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0 145 290 580 m

Scale: 1:15,000

Datum: GDA 1994 MGA Zone 56 - AHD

A3			
A	Original Issue - R01	BC	16-03-2018
Rev	Description	Drn.	Date

Legend:

Approximate Site Boundary

JBS&G

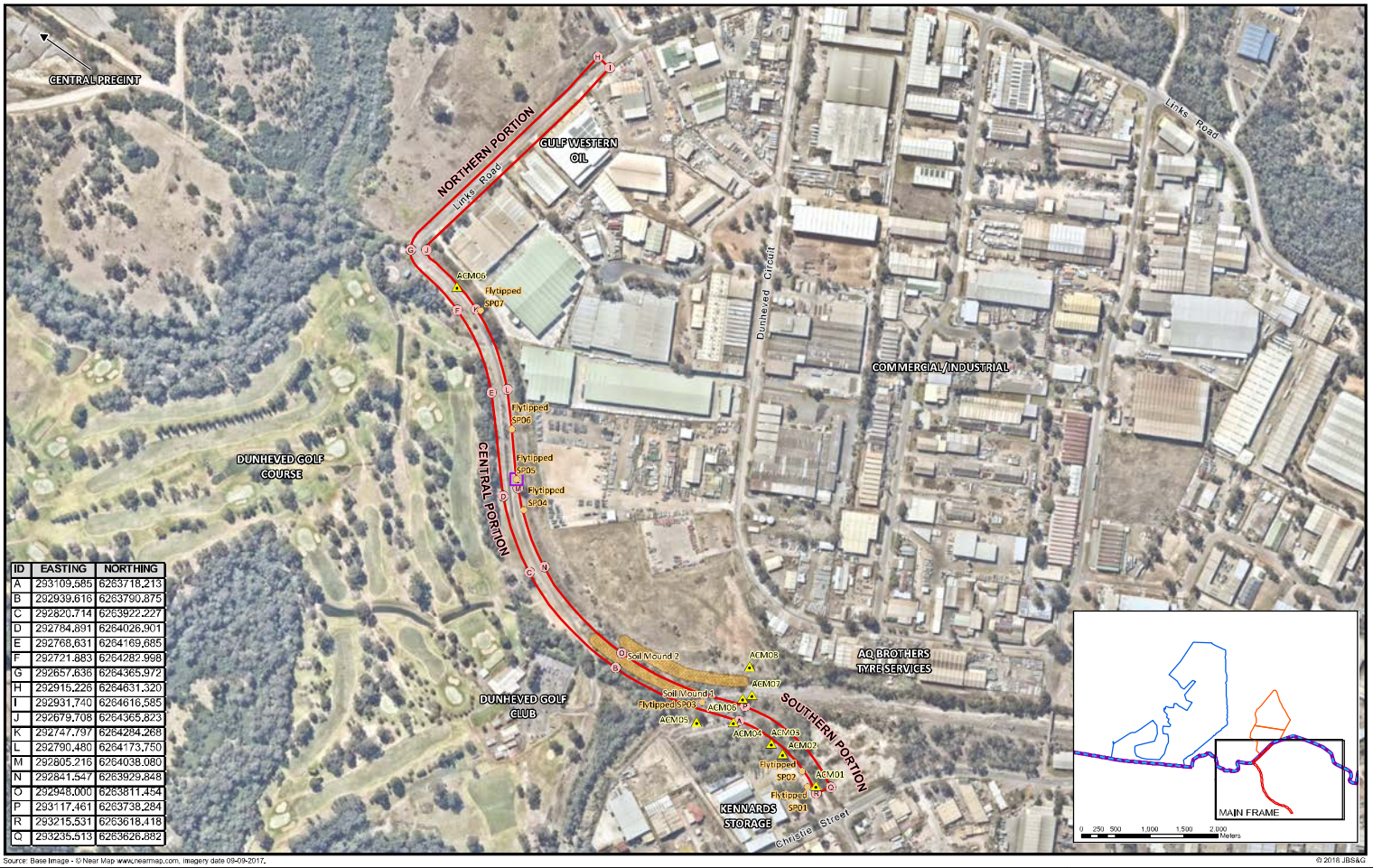
Figure 1: Site Location

Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_01

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018



ID	EASTING	NORTHING
A	293109.585	6263718.213
B	292939.616	6263790.875
C	292820.714	6263922.227
D	292784.891	6264026.901
E	292768.631	6264169.685
F	292721.883	6264282.998
G	292657.636	6264365.972
H	292915.226	6264631.320
I	292931.740	6264616.585
J	292679.708	6264365.823
K	292747.797	6264284.268
L	292790.480	6264173.750
M	292805.216	6264038.080
N	292841.547	6263929.848
O	292948.000	6263811.454
P	293117.461	6263738.284
R	293215.531	6263618.418
Q	293235.513	6263626.882

Source: Base Image - © Near Map www.nearmap.com, Imagery date 09-09-2017. © 2018 JBS&G

0 45 90 180 m

Scale 1:4,700

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Dm.	Date
A	Original Issue - R01	BC	28-03-2018

Legend:

- CHK001/1 Audit Statement Boundary
- Former ADI St Marys Property
- Central Precinct
- Dunheved Precinct
- Approximate Site Boundary
- Soil Mound Location
- ACM Location
- Stockpile Location
- Staining

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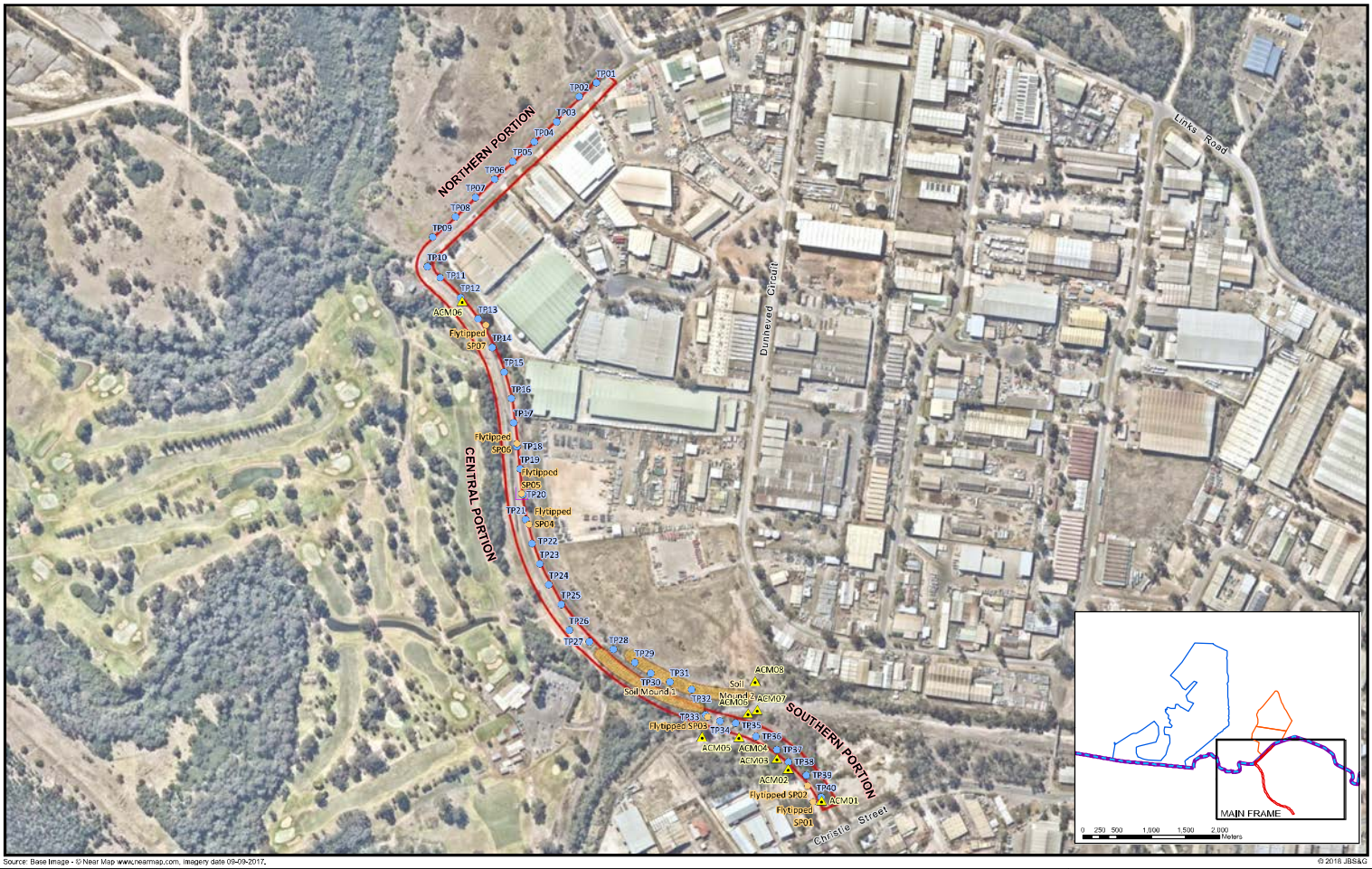
Figure 2: Site Layout and Surrounding Land Use

Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_02

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018



Source: Base Image - © Near Map www.nearmap.com, Imagery date 09-09-2017.

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0 45 90 180 m

Scale: 1:4,700

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Dm.	Date
A	Original Issue - R01	BC	28-03-2018

Legend:

- CHK001/1 Audit Statement Boundary
- Former ADI St Marys Property
- Central Precinct
- Dunheved Precinct
- Approximate Site Boundary
- Soil Mound Location
- Test Pit Location
- ACM Location
- Stockpile Location
- Staining

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Figure 3: Site Layout and Test Pit Locations

Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_03

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Tables

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Table 1. Soil Analytical Results
Job No. 54340
Links Rd St Marys

	Asbestos																		Heavy Metal							
	Approx. Sample Mass	Asbestos from ACM in Soil	Asbestos from FA & AF in Soil	Mass ACM	Mass Asbestos in ACM	Mass FA	Mass Asbestos in FA	Mass AF	Mass Asbestos in AF	Asbestos Reported Result	Mass Asbestos in FA & AF	Asbestos Sample Dimensions	ACM - Comment	AF - Comment	FA - Comment	Organic Fibres - Comment	Respirable Fibres - Comment	Synthetic Fibres - Comment	Arsenic (Total)	Cadmium	Chromium (Total)	Copper	Lead	Mercury (Inorganic)	Nickel	Zinc
	g	%w/w	%w/w	g	g	g	g	g	g	Comment	g	Comment	Comment	Comment	Comment	Comment	Comment	Comment	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL																			2.00	0.40	5.00	5.00	5.00	0.10	1.00	1.00
NEPM 2013 Ind. - Commercial industrial generic																			160		310	81	1800		65	400
NEPM 2013 FSL Commercial and Industrial, Fine Soil																										
NEPM 2013 Mgmt Limits - Commercial and industrial, Fine																										
NEPM 2013 Soil HSL D		0.05	0.001																3300	900	3600	240000	1500	730	6000	400000
NEPM 2013 Soil HSL D - Sensitive Setting																										
Field_ID	Depth	Date																								
TP001_0.0-0.1	0.0-0.1	5/02/2018	745	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	4.1	<0.4	86	37	35	<0.1	65	240
TP02_0.0-0.1	0.0-0.1	5/02/2018	906	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	7.2	<0.4	41	33	35	<0.1	39	230
TP03_0.0-0.1	0.0-0.1	5/02/2018	944	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	<2	<0.4	18	14	15	<0.1	16	72
TP04_0.0-0.1	0.0-0.1	5/02/2018	910	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	4.6	<0.4	36	56	41	<0.1	47	400
TP05_0.0-0.1	0.0-0.1	5/02/2018	889	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	6.2	<0.4	28	12	33	<0.1	13	98
TP06_0.0-0.1	0.0-0.1	5/02/2018	785	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	3.7	<0.4	76	23	36	<0.1	46	170
TP07_0.0-0.1	0.0-0.1	5/02/2018	1084	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	3.2	<0.4	32	26	34	<0.1	26	180
TP07_0.2-0.3	0.2-0.3	5/02/2018	762	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	12	<0.4	27	20	34	<0.1	13	180
TP08_0.0-0.1	0.0-0.1	5/02/2018	768	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	3.7	<0.4	35	29	35	<0.1	9	280
TP09_0.0-0.1	0.0-0.1	1/02/2018	813	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	6.7	<0.4	21	13	31	<0.1	7.6	550
TP10_0.0-0.1	0.0-0.1	1/02/2018	702	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	6.4	<0.4	26	8.8	16	0.1	<5	16
TP11_0.0-0.1	0.0-0.1	1/02/2018	700	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	7	<0.4	22	8.8	14	0.1	5	13
TP12_0.0-0.1	0.0-0.1	1/02/2018	817	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	6.4	<0.4	10	7.3	27	0.1	<5	19
QA20180202-03	0.0-0.1	1/02/2018	749	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	6.0	<0.4	24	7.9	10	0.1	<5	24
QC20180202-03		1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<4	<0.4	16	6	22	0.1	3	16
TP13_0.0-0.1	0.0-0.1	1/02/2018	760	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	6.0	<0.4	20	10	33	0.1	<5	35
TP14-0.0-0.1	0.0-0.1	1/02/2018	987	0	0.0005	0	0	0.007*	0.005	0	-	0.005	-	1	-	Chrysotile, amosite and crocidolite asbestos detected in weighed fibre cement fragments.	1	1	1	13	<0.4	31	17	33	0.1	7	31
TP14-0.0-0.1 ACM	0.0-0.1	1/02/2018	93	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	1	1	-		1	1	1	-	-	-	-	-	-	-	-
TP14 0.2-0.3	0.2-0.3	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP15-0.0-0.1	0.0-0.1	1/02/2018	764	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	3.2	<0.4	13	14	18	<0.1	5.9	67
TP16-0.0-0.1	0.0-0.1	1/02/2018	778	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	3.8	<0.4	13	10	34	<0.1	6.5	37
TP17 0.2-0.3	0.2-0.3	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP17-0.0-0.1	0.0-0.1	1/02/2018	875	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	8.7	<0.4	28	13	40	<0.1	5.1	34
TP18-0.0-0.1	0.0-0.1	1/02/2018	730	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	12	<0.4	33	23	83	0.1	9.7	130
QA20180202-01	0.0-0.1	1/02/2018	725	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	7.6	0.5	19	30	60	0.1	14	270
TP19-0.0-0.1	0.0-0.1	1/02/2018	926	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	8.0	<0.4	24	10	54	0.1	6	47
TP20 0.2-0.3	0.2-0.3	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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	Asbestos																		Heavy Metal							
	Approx. Sample Mass	Asbestos from ACM in Soil	Asbestos from FA & AF in Soil	Mass ACM	Mass Asbestos in ACM	Mass FA	Mass Asbestos in FA	Mass AF	Mass Asbestos in AF	Asbestos Reported Result	Mass Asbestos in FA & AF	Asbestos Sample Dimensions	ACM - Comment	AF - Comment	FA - Comment	Organic Fibres - Comment	Respirable Fibres - Comment	Synthetic Fibres - Comment	Arsenic (Total)	Cadmium	Chromium (Total)	Copper	Lead	Mercury (Inorganic)	Nickel	Zinc
	g	%w/w	%w/w	g	g	g	g	g	g	Comment	g	Comment	Comment	Comment	Comment	Comment	Comment	Comment	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL																			2.00	0.40	5.00	5.00	5.00	0.10	1.00	1.00
NEPM 2013 Ind. - Commercial industrial (generic)																			160		310	81	1600		65	400
NEPM 2013 FSL Commercial and Industrial, Fine Soil																										
NEPM 2013 Mgmt Limits - Commercial and industrial, Fine																										
NEPM 2013 Soil HSL D		0.05	0.001																3300	900	3600	240000	1500	730	6000	400000
NEPM 2013 Soil HSL D - Sensitive Setting																										
Field_ID	Depth	Date																								
TP20-0.0-0.1	0-0.1	1/10/2018	982	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	9	<0.4	27	26	83	<0.1	9.2	76
TP21-0.0-0.1	0-0.1	1/10/2018	973	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	7.5	0.5	29	33	140	<0.1	11	130
TP22-0.0-0.1	0-0.1	1/10/2018	940	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	6.7	<0.4	24	20	85	<0.1	7.9	65
TP22 0.7 0.3	0.7 0.3	1/10/2018	807	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1			1	1	1	3.3	<0.4	15	5.9	17	<0.1	<5	7.6
TP23 0 0.1	0 0.1	1/10/2018	755	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	3.9	<0.4	17	14	48	<0.1	7.1	37
TP24 0.7 0.3	0.7 0.3	1/10/2018	873	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	7.8	<0.4	9	7	11	<0.1	5.8	7.8
TP25 0 0.1	0 0.1	1/10/2018	837	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	5.8	<0.4	27	29	170	<0.1	11	76
TP26 0.7 0.3	0.7 0.3	1/10/2018	1133	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	22	<0.4	150	6.5	36	<0.1	9.2	8.8
TP27 0 0.1	0 0.1	1/02/2018	739	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	9.8	<0.4	25	17	41	<0.1	5.6	38
TP28 0 0.1	0 0.1	1/02/2018	1042	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	6.6	<0.4	30	19	79	<0.1	30	62
TP29 0.2 0.3	0.2 0.3	1/02/2018	739	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	7.3	<0.4	7.6	78	58	<0.1	19	76
TP30 0.2 0.3	0.2 0.3	1/02/2018																								
TP30 0.0 0.1	0 0.1	1/02/2018	854	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	4.3	<0.4	38	56	80	<0.1	39	130
TP31 0.2 0.3	0.2 0.3	1/02/2018	989	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	4.3	<0.4	26	86	86	<0.1	30	97
TP32 0.2 0.3	0.2 0.3	1/02/2018	1021	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	5	<0.4	25	76	57	<0.1	33	94
TP33 0.2 0.3	0.2 0.3	1/02/2018	724	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	9.6	<0.4	13	8.7	6.1	<0.1	<5	5.6
TP34 0.0 0.1	0 0.1	1/02/2018	601	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	7.6	<0.4	13	22	38	<0.1	11	150
QA20180201 01		1/02/2018	815	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-		1	1	1	7.1	<0.4	17	30	48	<0.1	14	210
QC20180201 01		1/02/2018																	5	<0.4	18	16	47	<0.1	6	110
TP35-0.0-0.1	0-0.1	1/02/2018	820	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	8.3	<0.4	16	13	14	<0.1	29	47
TP36-0.2-0.3	0.2-0.3	1/02/2018	1039	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	<2	<0.4	140	29	8.5	<0.1	84	30
TP37-0.2-0.3	0.2-0.3	1/02/2018	870	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	6.6	<0.5	21	22	21	<0.1	12	83
TP37-0.9-1.0	0.9-1	1/02/2018	568	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	7	<0.4	21	11	12	<0.1	<5	9.8
TP38-0.0-0.1	0-0.1	1/02/2018	770	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	6.7	<0.4	23	14	40	<0.1	7.6	38
TP39-0.0-0.1	0-0.1	1/02/2018	795	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	6.4	<0.4	53	21	22	<0.1	32	74
TP40-0.0-0.1	0-0.1	1/02/2018	593	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	13	<0.4	72	8.7	31	0.1	6.3	35
SP01-TP01-0.0-0.1 (Soil Stand 01)	0.0-0.1	1/02/2018	808	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	17	<0.4	48	7.7	16	0.1	<5	77

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	Asbestos																Heavy Metal							
	Approx. Sample Mass	Asbestos from ACM in Soil	Asbestos from FA & AF in Soil	Mass ACM	Mass Asbestos in ACM	Mass FA	Mass Asbestos in FA	Mass AF	Mass Asbestos in AF	Asbestos Reported Result	Mass Asbestos in FA & AF	Asbestos Sample Dimensions	ACM - Comment	AF - Comment	FA - Comment	Organic Fibres - Comment	Respirable Fibres - Comment	Synthetic Fibres - Comment	Arsenic (Total)	Cadmium	Chromium (Total)	Copper	Lead	Mercury (Inorganic)	Nickel	Zinc
	g	%w/w	%w/w	g	g	g	g	g	g	Comment	g	Comment	Comment	Comment	Comment	Comment	Comment	Comment	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL																			2.00	0.40	5.00	5.00	5.00	0.10	1.00	1.00
NEPM 2013 Ind. - Commercial industrial (generic)																			160		310	81	1800		65	400
NEPM 2013 FSL Commercial and Industrial, Fine Soil																										
NEPM 2013 Mgnt Limits - Commercial and Industrial, Fine																										
NEPM 2013 Soil HSL D		0.05	0.001																3300	900	3600	240000	1500	730	6000	400000
NEPM 2013 Soil HSL D - Sensitive Setting																										
Field_ID	Depth	Date																								
SP02-TP02-1.4-1.5 (Soil Mound 02)	1.4-1.5	1/02/2018	715	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	3.7	<0.4	8.4	8.2	8.7	<0.1	<5	11
SP02-TP02-3.9-4.0 (Soil Mound 02)	3.9-4	1/02/2018	895	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	-	1	-	-	1	1	1	4.4	<0.4	11	17	14	<0.1	9.5	32
ACMSP 01	1	1/02/2018	53	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	1	1	-	-	1	1	1	-	-	-	-	-	-	-	-
ACMSP 02	2	1/02/2018	26	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	1	1	-	-	1	1	1								
ACMSP 03	3	1/02/2018	<1	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	1	1	-	-	1	1	1								
DS01		1/02/2018																		6.9	<0.4	30	78	100	<0.1	13	130
FTSP01		1/02/2018	1088	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-	-	1	1	1	18	<0.4	85	31	63	<0.1	38	170
FTSP03		1/02/2018	767	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-	-	1	1	1	3.1	<0.4	23	14	32	<0.1	<5	65
FTSP03 ACM		1/02/2018	81	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0	1	1	-	-	1	1	1								
FTSP04		2/02/2018	900	0	0	0	0	0	0	0	No Asbestos detected at the reporting limit of 0.001% w/w	0		1	-	-	1	1	1	4.8	<0.4	15	24	33	0.2	11	90

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			OCP																										PAH																
			Hexachlorobenzene	4,4-DDE	Aldrin	Aldrin + Dieldrin (Sum of Total)	alpha-BHC	beta-BHC	Dieldrin	DDD	DDT	DDT+DDE+DDD (Sum of Total)	Chlordane	delta-BHC	Endosulfan alpha	Endosulfan beta	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	Heptachlor	Heptachlor Epoxide	Lindane	Methoxychlor	Toxaphene	Organochlorine Pesticides EPAVic	Other Organochlorine Pesticides EPAVic	Acenaphthene	Acenaphthylene	Anthracene	Benz[a]anthracene	Benzo[a]pyrene	Benzo[a]pyrene TEQ (lower bound)*	Benzo[a]pyrene TEQ (medium bound)*	Benzo[a]pyrene TEQ (upper bound)*	Benzo[b,j]fluoranthene	Benzo[g,h,i]perylene	Benzo[k]fluoranthene	Chrysene	Dibenz[a,h]anthracene	Fluoranthrene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Total)
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg kg	mg kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	1.00	0.10	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
NEPM 20_3 Int. - Commercial industrial generic											640																																		370			
NEPM 20_3 Fill Commercial industrial, Fine Soil																																1.4														
NEPM 20_3 Mgnt Limits - Commercial and industrial, Fine																																														
NEPM 20_3 Soil HIL D			80			45						480	530					100			50				2500	1900							400	440	480											4000
NEPM 20_3 Soil HSL D - Sensitive Scenario																																													NL			
Field_ID	Depth	Date																																														
TP001_0.0-0.1	0-0.1	5/02/2018																														<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	1.4	1.2	<0.5
TP002_0.0-0.1	0-0.1	5/02/2018	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	<0.1	<0.1	<0.5	<0.5	1.2	1.8	1.9	2.5	2.8	3	2.4	1.3	1.7	1.9	<0.5	5.5	0.5	1.1	<0.5	7.5	4.9	30.7
TP003_0.0-0.1	0-0.1	5/02/2018																											<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	0.6	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	0.6	1.8
TP004_0.0-0.1	0-0.1	5/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	0.6	1	1.3	1.6	1.8	0.8	1.2	0.8	0.7	<0.5	1.5	<0.5	1	<0.5	0.8	1.5	9.9
TP005_0.0-0.1	0-0.1	5/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	1	1.7	2.8	2.8	2.8	1	1.7	1.3	1.1	0.6	1.3	<0.5	1.3	<0.5	1.3	1.1	13.6
TP006_0.0-0.1	0-0.1	5/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	0.8	1	1.3	1.5	0.5	0.8	0.3	0.6	<0.5	1.1	<0.5	0.7	<0.5	3.0	1.1	0.7
TP007_0.0-0.1	0-0.1	5/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	0.5	1.7	2.2	2.9	3.1	3.4	1.8	1.5	1.7	1.9	<0.5	3.9	<0.5	1.3	<0.5	1.8	3.8	22.1
TP007_0.2-0.3	0.2-0.3	5/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	<0.5	1.9	4.8	5.8	8.2	8.2	8.2	1.9	3.5	4	4.6	1.1	12	<0.5	3	<0.5	7.9	11	64.3
TP008_0.0-0.1	0-0.1	5/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	1	1.4	1.8	2.1	2.3	1.2	1	0.9	1.3	<0.5	2.2	<0.5	0.7	<0.5	1.3	2.1	13.1
TP009_0.0-0.1	0-0.1	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TP10_0.0-0.1	0-0.1	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TP11_0.0-0.1	0-0.1	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TP12_0.0-0.1	0-0.1	1/02/2018	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	0.1	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
QA20180202-03	0-0.1	1/02/2018	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	0.1	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
QC20180202-03		1/02/2018	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<2	0.1	<0.1	<0.1	<0.1	0.1	0.2	0.23	-	0.5	<0.5	-	0.2	-	0.1	<0.1	0.2	<0.1	0.1	0.2	<0.1	3.2	0.4	3.8
TP13_0.0-0.1	0-0.1	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	<0.5	2.1	3.8	4.8	6.3	6.3	6.3	2.8	2.9	3.4	4	0.7	1.5	1.4	2.3	<0.5	11	11	68.6
TP14-0.0-0.1	0-0.1	1/02/2018	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	0.1	<0.1	6.1	3.3	26	28	30	62	66	66	24	35	28	38	9.3	190	7.5	30	5.1	83	120	604.3
TP14-0.0-0.1 ADM	0-0.1	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP16 0.2-0.3	0.2-0.3	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	<0.5	3.3	3.7	4.8	7.2	7.2	7.2	2.8	4.7	2.7	3.9	1	12	0.9	4	<0.5	9.9	12	66.2
TP15-0.0-0.1	0-0.1	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	0.6	1.2	1.5	1.9	2.2	2.4	1.1	<0.5	1	1.2	<0.5	3.8	<0.5	0.8	<0.5	2.9	3.6	17.7
TP16-0.0-0.1	0-0.1	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	0.9	1.3	1.7	1.9	2.2	1.1	<0.5	0.9	1	<0.5	3	<0.5	0.8	<0.5	2.7	2.9	13.6
TP17 0.2-0.3	0.2-0.3	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	0.6	0.7	1	1.3	0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	0.8	2.6
TP17-0.0-0.1	0-0.1	1/02/2018	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	0.1	<0.1	0.8	<0.5	3.6	8	9.6	14	17	14	7.3	6.8	9.9	8	1.7	35	2.4	5.3	1	36	31	153.2
TP18-0.0-0.1	0-0.1	1/02/2018	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	0.1	<0.1	1.1	0.8	4.2	9.8	16	25	25	25	10	3.5	9.4	11	3.3	28	1.8	11	0.6	24	25	162.5
QA20180202-01	0-0.1	1/02/2018	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	0.1	<0.1	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TP19-0.0-0.1	0-0.1	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	0.5	3.1	9	12	18	18	18	9.9	2.5	7.2	10	2.3	34	1.4	7.5	<0.5	20	31	151.3
TP20 0.2-0.3	0.2-0.3	1/02/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

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Table 1. Soil Analytical Results
Job No. 54340
Links Rd St Marys

| | | | OCP | | | | | | | | | | | | | | | | | | | | | | | | | | PAH | | | | | | | | | | | | | | | | | | |

Table 1. Soil Analytical Results
Job No. 54340
Links Rd St Marys

| | | | OCP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | PAH | | | | | | | | | | | | | | | | | | |

Table 1. Soil Analytical Results
Job No. 54340
Links Rd St Marys

			PCB								TRH												BTEX					
			Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	PCBs (Total)	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Total)	>C8-C9 Fraction	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C16 less Naphthalene (F2)	>C6-C10 Fraction	>C6-C10 less BTEX (F1)	Naphthalene	Benzene	Ethylbenzene	Toluene	Xylene (o)	Xylene (m & p)	Xylene (Total)
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.50	20.00	50.00	50.00	20.00	20.00	50.00	100.00	100.00	50.00	20.00	20.00	0.50	0.10	0.10	0.10	0.10	0.20	0.30
NEPM 20_3 Int. - Commercial industrial (generic)																						3.00						
NEPM 20_3 Fill Commercial use Industrial, Fine Soil																	2500	6600	170		215		65	185	135			95
NEPM 20_3 Mgmt Limits - Commercial and industrial, Fine																1000	5000	10000		800								
NEPM 20_3 Soil HIL D										1																		
NEPM 20_3 Soil HSL D - Sensitive Scenario																			VL			230	3	NL	NL			290
Field_ID	Depth	Date																										
TP001_0.0-0.1	0.0-0.1	5/22/2018									<20	57	70	127	<20	<50	100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP002_0.0-0.1	0.0-0.1	5/22/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<20	230	180	410	<20	<50	330	150	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP003_0.0-0.1	0.0-0.1	5/22/2018																										
TP004_0.0-0.1	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	<20	<50	160	160	<20	<50	150	200	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP005_0.0-0.1	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	<20	<50	<50	<50	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP006_0.0-0.1	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	<20	<50	<50	<50	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP007_0.0-0.1	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP007_0.2-0.3	0.2-0.3	5/22/2018	-	-	-	-	-	-	-	-	<20	210	110	320	<20	<50	280	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP008_0.0-0.1	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	<20	85	150	235	<20	<50	170	120	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP009_0.0-0.1	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP010_0.0-0.1	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	20	<50	<50	<50	20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP011_0.0-0.1	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	20	<50	<50	<50	20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP012_0.0-0.1	0.0-0.1	5/22/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	20	<50	<50	<50	20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
QA20180202-03	0.0-0.1	5/22/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	20	<50	<50	<50	20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
QC20180202-03		5/22/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	50	<100	<100	<50	25	<50	<100	<100	<50	<25	<25	<1	<0.2	<1	<0.5	<1	<2	<1
TP13_0.0-0.1	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	20	170	72	242	20	<50	200	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP14-0.0-0.1	0.0-0.1	5/22/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	32	1900	930	2862	20	93	2300	550	93	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP14-0.0-0.1 ACM	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP14 0.2-0.3	0.2-0.3	5/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP15-0.0-0.1	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	<20	370	310	720	<20	<50	660	120	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP16-0.0-0.1	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP17 0.2-0.3	0.2-0.3	5/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP17-0.0-0.1	0.0-0.1	5/22/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	27	660	170	857	<20	62	670	<100	62	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP18-0.0-0.1	0.0-0.1	5/22/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	20	190	250	730	20	<50	590	180	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
QA20180202-01	0.0-0.1	5/22/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	20	<50	<50	<50	20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP19-0.0-0.1	0.0-0.1	5/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP20 0.2-0.3	0.2-0.3	5/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Table 1. Soil Analytical Results
Job No. 54340
Links Rd St Marys

			PCB								TRH												BTEX					
			Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	PCBs (Total)	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Total)	>C8-C9 Fraction	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C16 less Naphthalene (F2)	>C6-C10 Fraction	>C6-C10 less BTEX (F1)	Naphthalene	Benzene	Ethylbenzene	Toluene	Xylene (o)	Xylene (m & p)	Xylene (Total)
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	20.00	50.00	50.00	20.00	20.00	50.00	100.00	100.00	50.00	20.00	20.00	0.50	0.20	0.10	0.20	0.10	0.20	0.30
MECP 20_3 Int. - Commercial industrial (generic)																						3.70						
MECP 20_3 Int. - Commercial coarse (industrial, fine)																	7500	6600	570		715		93	185	135			95
MECP 20_3 Agri Limits - Commercial and industrial, Fine																1000	5000	10000		800								
MECP 20_3 Soil H L.U										/																		
MECP 20_3 Soil HSL D - Sensitive Settings																			VL		250	NL	3	NL	NL			230
Field_ID	Depth	Date																										
TP2(0.5-0.1	0-0.1	7/27/2018	-	-	-	-	-	-	-	-	35	2500	1300	3835	<20	100	32000	4100	300	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP3 (0.5-0.1	0-0.1	7/27/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<20	59	47	146	<20	<50	110	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP72-0.5-0.1	0-0.1	7/27/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP72 0.7 0.3	0.7 0.3	7/27/2018																										
TP73 0 0.1	0 0.1	7/27/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<20	<50	<50	<50	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP74 0.7 0.3	0.7 0.3	7/27/2018									<20	<50	<50	<50	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP75 0 0.1	0 0.1	7/27/2018																										
TP76 0.7 0.3	0.7 0.3	7/27/2018									<20	<50	<20	<50	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP27 0 0.1	0 0.1	1/22/2018									<20	100	72	172	<20	<50	150	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP28 0 0.1	0 0.1	1/22/2018																										
TP29 0.2 0.3	0.2 0.3	1/22/2018																										
TP30 0.2 0.3	0.2 0.3	1/22/2018																										
TP30 0.0 0.1	0 0.1	1/22/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	30	680	210	920	<20	<50	700	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP31 0.2 0.3	0.2 0.3	1/22/2018									<20	<50	<20	<50	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP32 0.2 0.3	0.2 0.3	1/22/2018																										
TP33 0.2 0.3	0.2 0.3	1/22/2018																										
TP34 0.0 0.1	0 0.1	1/22/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<20	<50	<20	<50	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
QA20180201 01		1/22/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<20	<50	<20	<50	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
QC20180201 01		1/22/2018	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	350	300		<25	<50	570	180	<50	<25	<25	<1	<0.2	<1	<0.5	<1	<2	<3
TP35-0.5-0.1	0-0.1	1/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP36-0.2-0.3	0.2-0.3	1/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP37-0.2-0.3	0.2-0.3	1/22/2018	-	-	-	-	-	-	-	-	<20	<50	<20	<50	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP37-0.5-1.0	0.5-1	1/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP38-0.5-0.1	0-0.1	1/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP39-0.5-0.1	0-0.1	1/22/2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<20	<50	52	52	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
TP40-0.5-0.1	0-0.1	1/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SP01-TP01-0.5-0.9 (Soil Stand in)	0.5-0.9	1/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Document Set ID: 8477747
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Table 1. Soil Analytical Results
Job No. 54340
Links Rd St Marys

			PCB								TRH												BTEX					
			Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	PCBs (Total)	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Total)	>C8-C9 Fraction	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C16 less Naphthalene (F2)	>C6-C10 Fraction	>C6-C10 less BTEX (F1)	Naphthalene	Benzene	Ethylbenzene	Toluene	Xylene (o)	Xylene (m & p)	Xylene (Total)
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.50	20.00	50.00	50.00	20.00	20.00	50.00	100.00	100.00	50.00	20.00	20.00	0.50	0.20	0.10	0.20	0.10	0.20	0.30
MEPV 20.3 Int. - Commercial industrial (generic)																												
MEPV 20.3 Fill Commercial use including Fine Soil																	2500	6600	170		215		95	185	135			95
MEPV 20.3 Agri Limits - Commercial and industrial Fine																1000	5000	10000		800								
MEPV 20.3 Soil H L D									/																			
MEPV 20.3 Soil HSL D - Sensitive Setting																			VL		250	NL	3	NL	NL			290
Field_ID	Depth	Date																										
SMW2-TP02-1.4-1.5 (Soil Mound 02)	1.4-1.5	1/22/2018	-	-	-	-	-	-	-	-	<20	<50	<50	<50	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
SMW2-TP02-0.9-1.0 (Soil Mound 02)	0.9-1	1/22/2018	<0.1	<1	<1.1	<0.1	<0.1	<5	<0.1	<0.1	<20	<50	<50	<50	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
AC-MSP-01	1	1/22/2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AC-MSP-02	2	1/22/2018																										
AC-MSP-03	3	1/22/2018																										
TP01		1/22/2018									580	8400	130	9050	<20	1900	6300	<100	1900	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
FTSP01		1/22/2018									<20	<50	67	67	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
FTSP03		1/22/2018																										
FTSP03 ACV		1/22/2018																										
FTSP04		1/22/2018									<20	<50	<20	<50	<20	<50	<100	<100	<50	<20	<20	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3

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Table 2. Soil Analytical Results, TCLP
Job No. 54340
Links Rd St Marys

	PAH																	TCLP			
	Acenaphthene	Acenaphthylene	Anthracene	Benz[a]anthracene	Benzo[a]pyrene	Benzo[b,j]fluoranthene	Benzo[g,h,i]perylene	Benzo[k]fluoranthene	Chrysene	Dibenz[a,h]anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Total)	pH (TCLP - HCl addition)	pH (TCLP - initial)	pH (TCLP - off)	pH (Leachate fluid)
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pH Units	pH Units	pH Units	pH Units
RDL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10
Field_ID	**LocCode**	**Sample Depth**	**Date**																		
TP14 0-0.1	TP14	0-0.1	2/02/2018	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002	<0.001	0.003	1.6	5.9	5.2	5
TP17 0-0.1	TP17	0-0.1	2/02/2018	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	1.7	5.6	5.2	5
TP20 0 0.1	TP20	0 0.1	2/02/2018	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.002	1.6	5.5	5.2	5
TP30 0-0.1	TP30	0-0.1	1/02/2018	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.7	7.6	5.7	5

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Appendix A Photographic Log

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Photograph 1 –Northern Portion of Site



Photograph 2 – Northern Portion of Site



Photograph 3 – Northern Road Verge in Northern Portion of Site



Photograph 4 – General Rubbish in Northern Portion of Site



JBS&G

Job No: 54340	
Client: Maryland Development	
Version:	Date: 16/02/2018
Drawn By: RS	Checked By: KL
Not to Scale	
Coord. Sys n/a	

PHOTOGRAPHIC LOG

APPENDIX A

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Photograph 5 – Central Section, Golf course and Rail Line



Photograph 6 – Bonded Asbestos (ACM 09)



Photograph 7 – Old Rail Line



Photograph 8 – Fly Tipped Stockpile 04



JBS&G

Job No: 54340	
Client: Maryland Development	
Version:	Date: 16/02/2018
Drawn By: RS	Checked By: KL
Not to Scale	
Coord. Sys n/a	

PHOTOGRAPHIC LOG

APPENDIX A

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Photograph 9 – Fly Tipped Stockpile 05



Photograph 10 – Dark Stained Area



Photograph 11 – Fly Tipped Stockpile 06



Photograph 12 – Fly Tipped Stockpile 07



JBS&G

Job No: 54340	
Client: Maryland Development	
Version:	Date: 16/02/2018
Drawn By: RS	Checked By: KL
Not to Scale	
Coord. Sys n/a	

PHOTOGRAPHIC LOG

APPENDIX A

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Photograph 13 – Southern Portion and ACM 01 Surface Impacted Area



Photograph 14 – Fly Tipped Stockpile 01



Photograph 15 – Fly Tipped Stockpile 02



Photograph 16 – ACM 01 Surface Impacted Area



JBS&G

Job No: 54340	
Client: Maryland Development	
Version:	Date: 16/02/2018
Drawn By: RS	Checked By: KL
Not to Scale	
Coord. Sys n/a	

PHOTOGRAPHIC LOG

APPENDIX A

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Photograph 17 – ACM 02 (Stockpile)



Photograph 18 – ACM 03 (Stockpile)



Photograph 19 – ACM 04 (Stockpile)



Photograph 20 – ACM 05 (Stockpile)



JBS&G

Job No: 54340	
Client: Maryland Development	
Version:	Date: 16/02/2018
Drawn By: RS	Checked By: KL
Not to Scale	
Coord. Sys n/a	

PHOTOGRAPHIC LOG

APPENDIX A

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Photograph 21 – ACM 07 (Stockpile)



Photograph 22 –ACM 08 (Stockpile)



Photograph 23 – Soil Mound 01



Photograph 24 – Soil Mound 02



JBS&G

Job No: 54340	
Client: Maryland Development	
Version:	Date: 16/02/2018
Drawn By: RS	Checked By: KL
Not to Scale	
Coord. Sys n/a	

PHOTOGRAPHIC LOG

APPENDIX A

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Photograph 25 – Stockpile of Rail Sleepers



Photograph 26 – Shed and Rail Sleepers



Photograph 27 – Rail Ballast Track in Southern Portion of Site



Photograph 28 – Fly tipped Material within Southern Portion



JBS&G

Job No: 54340	
Client: Maryland Development	
Version:	Date: 16/02/2018
Drawn By: RS	Checked By: KL
Not to Scale	
Coord. Sys n/a	

PHOTOGRAPHIC LOG

APPENDIX A

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Appendix B Registered Groundwater Monitoring Wells

Document Set ID: 8477747
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Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW109584

Licence: 10BL163661 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Well
Work Status:
Construct.Method: Hand Auger
Owner Type: Private

Commenced Date: **Final Depth:** 8.20 m
Completion Date: 14/01/2003 **Drilled Depth:** 8.20 m

Contractor Name: Macquarie Drilling
Driller: Unkown Unknown
Assistant Driller:

Property: MOBIL OIL CNR CHRISTIE ST & FORRESTER ST ST MARYS 2760 **Standing Water Level:** 2.890
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	51//774585
Licensed:			

Region: 10 - Sydney South Coast **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6263554.0 **Latitude:** 33°44'53.1"S
Elevation Source: Unknown **Easting:** 294075.0 **Longitude:** 150°46'36.7"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Construction

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	8.20	95			Hand Auger
1	1	Casing	P.V.C.	0.00	0.00	50			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
0.00	0.00	0.00	Unknown	2.89					

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.20	0.20	CONCRETE	Conglomerate	
0.20	0.70	0.50	CLAY	Clay	
0.70	1.60	0.90	CLAY,GREY,ORANGE	Clay	
1.60	2.20	0.60	GRAVELLY CLAY,HARD , DRY	Gravelly Sandstone	
2.20	5.50	3.30	CLAY,MOISTURE,FIRM	Clay	
5.50	8.20	2.70	SHALE,BEDROCK,DARK GREY	Shale	

Remarks

***** End of GW109584 *****

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW109585

Licence: 10BL163661 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Well
Work Status:
Construct.Method:
Owner Type: Private

Commenced Date: **Final Depth:** 8.20 m
Completion Date: 14/01/2003 **Drilled Depth:**

Contractor Name: Macquarie Drilling
Driller: Unkown Unknown
Assistant Driller:

Property: MOBIL OIL CNR CHRISTIE ST & FORRESTER ST ST MARYS 2760 **Standing Water Level:** 2.400
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	51//774585
Licensed:			

Region: 10 - Sydney South Coast **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6263554.0 **Latitude:** 33°44'53.1"S
Elevation Source: Unknown **Easting:** 294062.0 **Longitude:** 150°46'36.2"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Construction

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	8.20	125			Hand Auger

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.20	0.20	CONCRETE	Unknown	
0.20	0.60	0.40	FILL,CLAY	Unknown	
0.60	3.90	3.30	CLAY,MOTTLED RED,BROWN	Unknown	
3.90	6.20	2.30	GRAVELLY CLAY	Unknown	
6.20	8.20	2.00	SHALE	Unknown	

Remarks

***** End of GW109585 *****

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW109586

Licence: 10BL163661 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Well
Work Status:
Construct.Method: Hand Auger
Owner Type: Private

Commenced Date: **Final Depth:** 1.50 m
Completion Date: 15/01/2003 **Drilled Depth:** 1.50 m

Contractor Name: Macquarie Drilling
Driller: Unkown Unknown
Assistant Driller:

Property: MOBIL OIL CNR CHRISTIE ST & FORRESTER ST ST MARYS 2760 **Standing Water Level:**
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	51//774585
Licensed:			

Region: 10 - Sydney South Coast **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6263598.0 **Latitude:** 33°44'51.7"S
Elevation Source: Unknown **Easting:** 294063.0 **Longitude:** 150°46'36.3"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Construction

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	1.50	125			Hand Auger
1	1	Casing	P.V.C.	0.00	0.00	50			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.20	0.20	CONCRETE	Conglomerate	
0.20	0.70	0.50	FILL,CLAY	Fill	
0.70	1.50	0.80	CLAY,FIRM TO STIFF	Clay	

Remarks

*** End of GW109586 ***

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW109587

Licence: 10BL163661 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Well
Work Status:
Construct.Method: Hand Auger
Owner Type: Private

Commenced Date: **Final Depth:** 8.20 m
Completion Date: 15/01/2003 **Drilled Depth:** 8.20 m

Contractor Name: Macquarie Drilling
Driller: Unkown Unknown
Assistant Driller:

Property: MOBIL OIL CNR CHRISTIE ST & FORRESTER ST ST MARYS 2760 **Standing Water Level:** 6.700
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	51//774585
Licensed:			

Region: 10 - Sydney South Coast **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6263554.0 **Latitude:** 33°44'53.1"S
Elevation Source: Unknown **Easting:** 294035.0 **Longitude:** 150°46'35.2"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Construction

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	8.20	125			Hand Auger
1	1	Casing	P.V.C.	0.00	0.00	50			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
0.00	0.00	0.00	Unknown	6.70					

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.20	0.20	CONCRETE	Conglomerate	
0.20	0.40	0.20	FILL	Fill	
0.40	3.50	3.10	CLAY,VERY STIFF	Clay	
3.50	5.00	1.50	GRAVELLY CLAY	Gravelly Sandstone	
5.00	7.50	2.50	CLAY,FIRM BROWN	Clay	
7.50	8.20	0.70	SHALE,WHITE,GREY	Shale	

Remarks

***** End of GW109587 *****

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW109588

Licence: 10BL163661 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Well
Work Status:
Construct.Method: Hand Auger
Owner Type: Private

Commenced Date: **Final Depth:** 8.20 m
Completion Date: 16/01/2003 **Drilled Depth:** 8.20 m

Contractor Name: Macquarie Drilling
Driller: Unkown Unknown
Assistant Driller:

Property: MOBIL OIL CNR CHRISTIE ST & FORRESTER ST ST MARYS 2760 **Standing Water Level:** 2.620
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	51//774585
Licensed:			

Region: 10 - Sydney South Coast **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6263585.0 **Latitude:** 33°44'52.1"S
Elevation Source: Unknown **Easting:** 294055.0 **Longitude:** 150°46'36.0"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Construction

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	8.20	125			Hand Auger
1	1	Casing	P.V.C.	0.00	0.00	50			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
0.00	0.00	0.00	Unknown	2.62					

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.20	0.20	CONCRETE	Conglomerate	
0.20	0.70	0.50	FILL,CLAY	Fill	
0.70	2.60	1.90	CLAY,FIRM,ORANGE	Clay	
2.60	4.20	1.60	GRAVELLY CLAY	Gravelly Sandstone	
4.20	7.20	3.00	CLAY,FIRM,BROWN,SOME GRAVEL	Clay	
7.20	8.20	1.00	SHALE,GREY,HARD	Shale	

Remarks

***** End of GW109588 *****

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW111461

Licence: 10BL604466 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method: Rotary - Coring
Owner Type: Other Govt

Commenced Date:
Completion Date: 31/03/2011
Final Depth: 11.02 m
Drilled Depth: 9.18 m

Contractor Name:
Driller: Daniel Giles Fox
Assistant Driller:

Property: SYDNEY WATER 53 - 73 LINKS ROAD ST MARYS 2760 NSW
GWMA:
GW Zone:
Standing Water Level:
Salinity:
Yield: 0.300

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	1//223888
Licensed:			

Region: 10 - Sydney South Coast
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6264950.0
Easting: 293280.0
Latitude: 33°44'07.3"S
Longitude: 150°46'07.0"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	0.20	0			Rotary - Coring
1		Hole	Hole	0.20	11.02	0			Auger - Solid Flight
1		Annulus	Bentonite/Grout	7.02	7.52				
1		Annulus	Waterworn/Rounded	7.52	11.02				Graded
1	1	Casing	Pvc Class 18	0.00	8.02	50	46		Cemented, Screwed
1	1	Opening	Slots - Horizontal	8.02	11.02			1	Casing - Machine Slotted, PVC Class 18, Screwed

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
8.47	11.02	2.55	Unknown			0.30		00:30:00	

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.20	0.20	FILL	Fill	
0.20	0.40	0.20	SAND FILL,WET	Sand	
0.40	0.60	0.20	CLAY MOTTLED	Clay	
0.60	4.60	4.00	CLAY RED ,MOTTLED,PLASTIC	Clay	
4.60	6.60	2.00	CLAY YELLOW BROWN,VERY PLASTIC	Clay	
6.60	7.80	1.20	SHALE WEATHERED GREY	Shale	
7.80	9.18	1.38	SHALE SILVER GREY,WEATHERED	Shale	

Remarks

***** End of GW111461 *****

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW111462

Licence: 10BL604466 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method: Auger - Solid Flight
Owner Type: Other Govt

Commenced Date:
Completion Date: 31/03/2011
Final Depth: 9.77 m
Drilled Depth: 11.02 m

Contractor Name:
Driller: Daniel Giles Fox
Assistant Driller:

Property: SYDNEY WATER 53 - 73 LINKS ROAD ST MARYS 2760 NSW
GWMA:
GW Zone:
Standing Water Level:
Salinity:
Yield: 0.300

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	1//223888
Licensed:			

Region: 10 - Sydney South Coast
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6264746.0
Easting: 293186.0
Latitude: 33°44'13.8"S
Longitude: 150°46'03.2"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	9.77	0			Auger - Solid Flight
1		Annulus	Bentonite/Grout	5.77	6.27				
1		Annulus	Waterworn/Rounded	6.27	9.77				Graded
1	1	Casing	Pvc Class 18	0.00	6.77	50	46		Cemented, Screwed
1	1	Opening	Slots - Horizontal	6.77	9.77			1	Casing - Machine Slotted, PVC Class 18, Screwed

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
4.46	9.77	5.31	Unknown			0.30		01:10:00	

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.15	0.15	FILL	Fill	
0.15	0.25	0.10	FILL ROAD BASE	Fill	
0.25	3.80	3.55	CLAY MOTTLED,RED/BROWN	Clay	
3.80	4.00	0.20	CLAY,RED,STIFF,SLIGHTLY DRY	Clay	
4.00	6.80	2.80	CLAY YELLOW BROWN,NOT STIFF	Clay	
6.80	8.45	1.65	SHALE,WEATHERED BROWN/GREY	Shale	
8.45	11.02	2.57	SHALE,SILVER/GREY,WEATHERED,DRY	Shale	

Remarks

***** End of GW111462 *****

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Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW111463

Licence: 10BL604466 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method: Rotary - Coring
Owner Type: Other Govt

Commenced Date:
Completion Date: 31/03/2011
Final Depth: 9.18 m
Drilled Depth: 9.77 m

Contractor Name:
Driller: Daniel Giles Fox
Assistant Driller:

Property: SYDNEY WATER 53 - 73 LINKS ROAD ST MARYS 2760 NSW
GWMA:
GW Zone:
Standing Water Level:
Salinity:
Yield: 0.300

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	1//223888
Licensed:			

Region: 10 - Sydney South Coast
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6264773.0
Easting: 293091.0
Latitude: 33°44'12.9"S
Longitude: 150°45'59.5"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	0.20	0			Rotary - Coring
1		Hole	Hole	0.20	9.18	0			Auger - Solid Flight
1		Annulus	Bentonite/Grout	5.18	5.68				
1		Annulus	Waterworn/Rounded	5.68	9.18				Graded
1	1	Casing	Pvc Class 18	0.00	6.18	50	46		Cemented, Screwed
1	1	Opening	Slots - Horizontal	6.18	9.18			1	Casing - Machine Slotted, PVC Class 18, Screwed

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
7.02	9.18	2.16	Unknown			0.30		01:35:00	

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.20	0.20	FILL , ROAD BASE	Fill	
0.20	0.40	0.20	SAND,BROWN,FINE,SLIGHTLY DAMP	Sand	
0.40	3.00	2.60	CLAY GRADING TO RED CLAYS,DRY,MIOTTLED	Clay	
3.00	3.60	0.60	SAND YELLOW/LIGHT BROWN,DRY,LOOSE	Sand	
3.60	4.20	0.60	SAND,ORANGE/ BROWN,DRY,LOOSE	Sand	
4.20	5.00	0.80	SAND,LIGHT BROWN,NOT PLASTIC,LOOSE	Sand	
5.00	5.45	0.45	CLAY MOTTLED,YELLOW,GREY	Clay	
5.45	7.00	1.55	SHALE.SILVERY GREY,WEATHERED	Shale	
7.00	8.00	1.00	SHALE,GREY BROWN,WEATHERED,BRITTLE	Shale	
8.00	9.77	1.77	SHALE,LIGHT GREY,HARD AND DRY.BRITTLE	Shale	

Remarks

***** End of GW111463 *****

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW113127

Licence: 10BL603327 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method:
Owner Type: Private

Commenced Date: **Final Depth:**
Completion Date: 21/04/2009 **Drilled Depth:**

Contractor Name:
Driller: Dino Parisotto
Assistant Driller:

Property: SIMS MANUFACTURING 76 - 100 CHRISTIE STREET ST MARYS 2760 NSW **Standing Water Level:**
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	1//1077263
Licensed:			

Region: 10 - Sydney South Coast **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6263398.0 **Latitude:** 33°44'57.4"S
Elevation Source: Unknown **Easting:** 292963.0 **Longitude:** 150°45'53.4"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

29/07/2014: Nat Carling, 29-July-2014; Added status, drill method, depth & work name.

***** End of GW113127 *****

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW113130

Licence: 10BL603327 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method:
Owner Type: Private

Commenced Date: **Final Depth:**
Completion Date: 22/04/2009 **Drilled Depth:**

Contractor Name:
Driller: Dino Parisotto
Assistant Driller:

Property: SIMS MANUFACTURING 76 - 100 CHRISTIE STREET ST MARYS 2760 NSW **Standing Water Level:**
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	1//1077263
Licensed:			

Region: 10 - Sydney South Coast **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6263448.0 **Latitude:** 33°44'55.9"S
Elevation Source: Unknown **Easting:** 293126.0 **Longitude:** 150°45'59.8"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

29/07/2014: Nat Carling, 29-July-2014; Added status, drill method, depth & work name.

*** End of GW113130 ***

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW113131

Licence: 10BL603327 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method:
Owner Type: Private

Commenced Date: **Final Depth:**
Completion Date: 27/05/2009 **Drilled Depth:**

Contractor Name:
Driller: Dino Parisotto
Assistant Driller:

Property: SIMS MANUFACTURING 76 - 100 CHRISTIE STREET ST MARYS 2760 NSW **Standing Water Level:**
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	1//1077263
Licensed:			

Region: 10 - Sydney South Coast **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6263370.0 **Latitude:** 33°44'58.4"S
Elevation Source: Unknown **Easting:** 293030.0 **Longitude:** 150°45'56.0"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

29/07/2014: Nat Carling, 29-July-2014; Added status, drill method, depth & work name.

*** End of GW113131 ***

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW113134

Licence: 10BL603327 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method:
Owner Type: Private

Commenced Date: **Final Depth:**
Completion Date: 28/05/2009 **Drilled Depth:**

Contractor Name:
Driller: Dino Parisotto
Assistant Driller:

Property: SIMS MANUFACTURING 76 - 100 CHRISTIE STREET ST MARYS 2760 NSW **Standing Water Level:**
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	1//1077263
Licensed:			

Region: 10 - Sydney South Coast **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6263433.0 **Latitude:** 33°44'56.3"S
Elevation Source: Unknown **Easting:** 292980.0 **Longitude:** 150°45'54.1"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

29/07/2014: Nat Carling, 29-July-2014; Added status, drill method, depth & work name.

***** End of GW113134 *****

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

NSW Office of Water
Work Summary

GW113135

Licence: 10BL603327 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method:
Owner Type: Private

Commenced Date: **Final Depth:**
Completion Date: 28/05/2009 **Drilled Depth:**

Contractor Name:
Driller: Dino Parisotto
Assistant Driller:

Property: SIMS MANUFACTURING 76 - 100 CHRISTIE STREET ST MARYS 2760 NSW **Standing Water Level:**
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	CUMBE	CUMBE.42	1//1077263
Licensed:			

Region: 10 - Sydney South Coast **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6263491.0 **Latitude:** 33°44'54.5"S
Elevation Source: Unknown **Easting:** 293133.0 **Longitude:** 150°46'00.1"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

29/07/2014: Nat Carling, 29-July-2014; Added status, drill method, depth & work name.

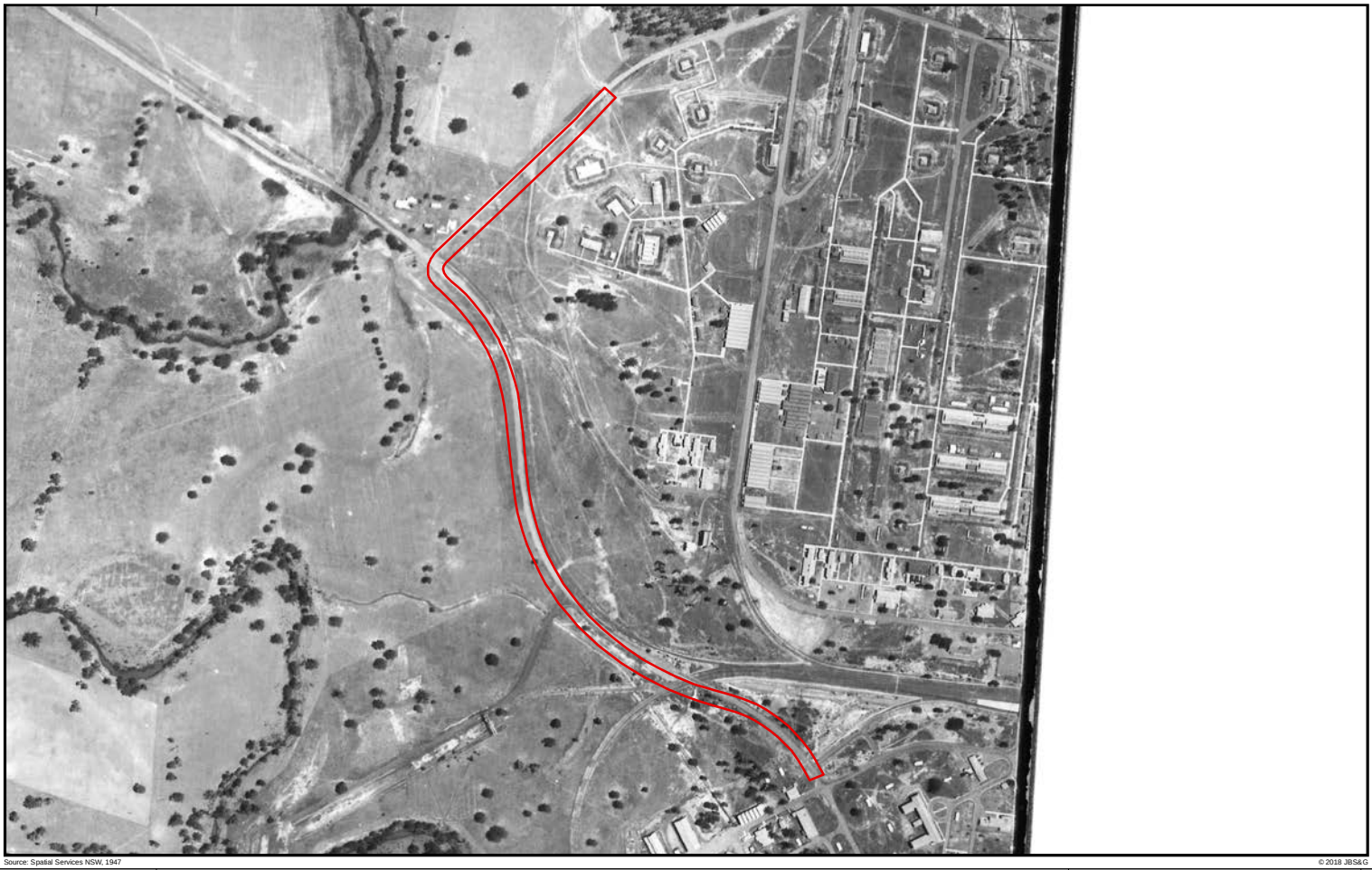
***** End of GW113135 *****

Warning To Clients: This raw data has been supplied to the NSW Office of Water by drillers, licensees and other sources. The NOW does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Appendix C Historical Aerial Photographs

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018



Source: Spatial Services NSW, 1947

© 2018 JBS&G

0 45 90 180 m

Scale: 1:5,000

Datum: GDA 1994 MGA Zone 56 - AHD

A3

Rev	Description	Drn.	Date
A	R01	BC	16-03-2018

Legend:

Approximate Site Boundary

JBS&G **Historical Aerial 1947**

Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_1947

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018



Source: Spatial Services NSW, 1955

© 2018 JBS&G

0 45 90 180 m

Scale: 1:5,000

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date
A3			
A	R01	BC	16-03-2018

Legend:

Approximate Site Boundary

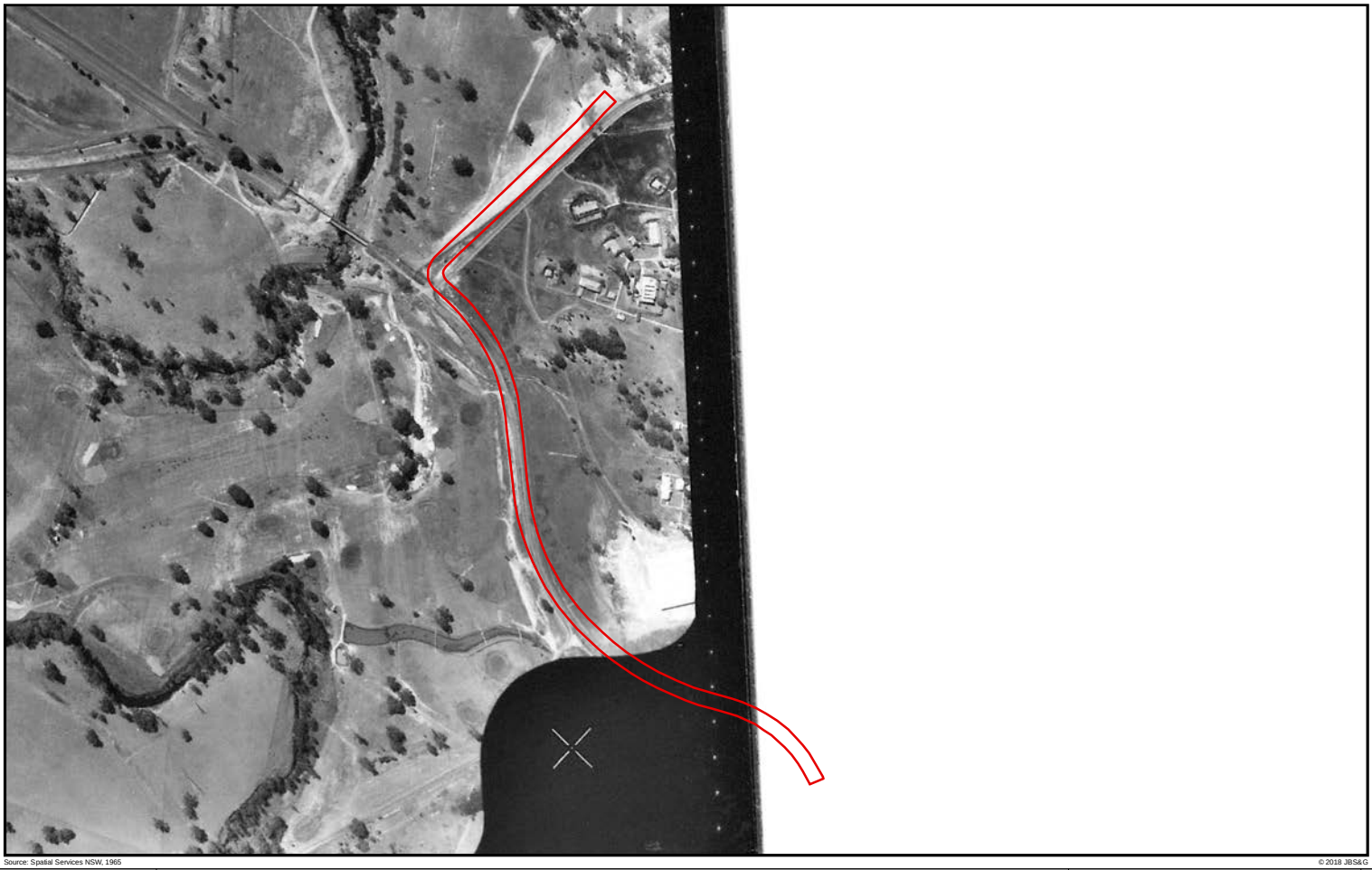
JBS&G **Historical Aerial 1955**

Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_1955

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018



Source: Spatial Services NSW, 1965

© 2018 JBS&G

0 45 90 180 m

Scale: 1:5,000

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date
A3			
A	R01	BC	16-03-2018

Legend:

Approximate Site Boundary

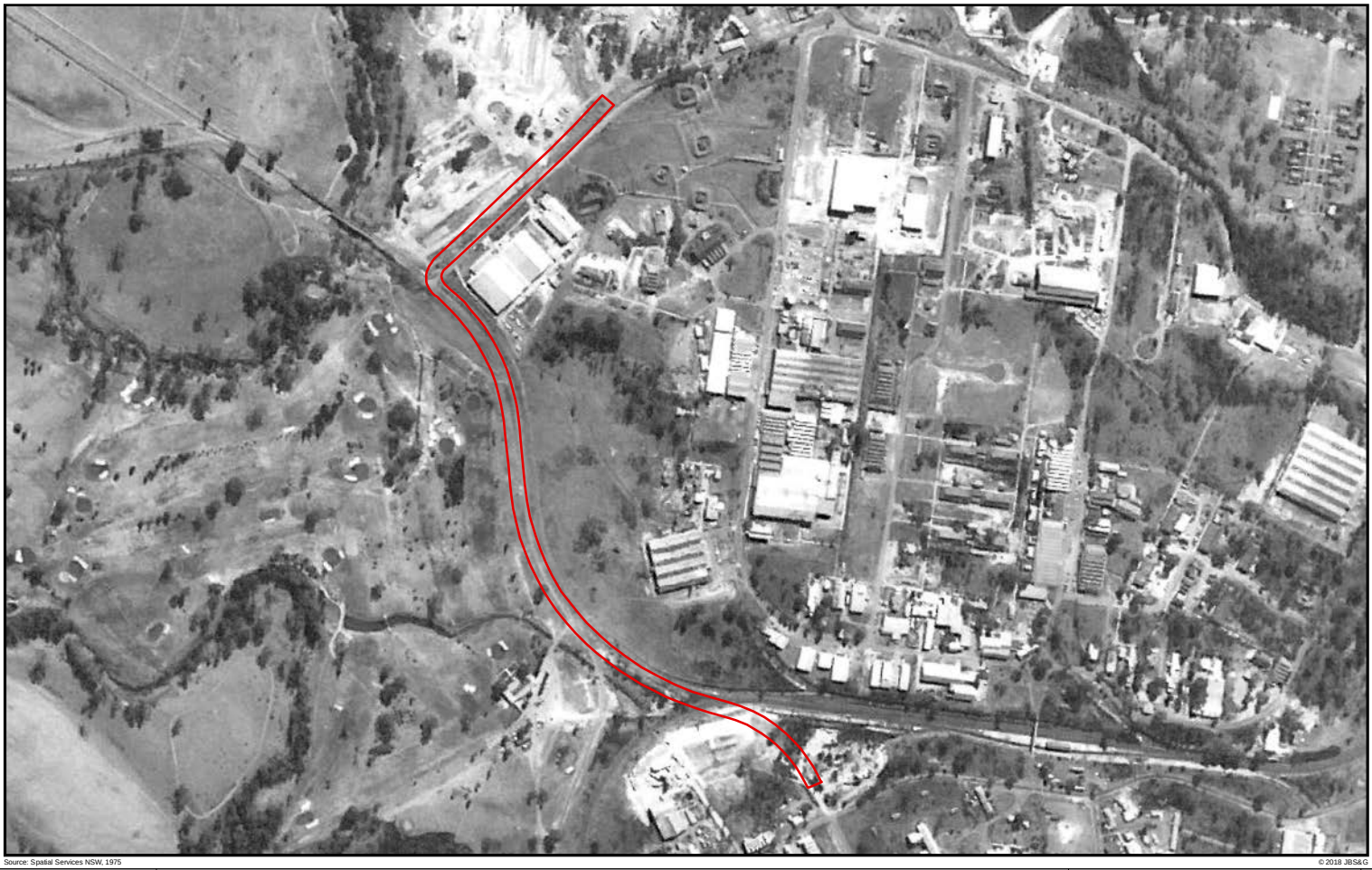
JBS&G **Historical Aerial 1965**

Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_1965

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018



Source: Spatial Services NSW, 1975

© 2018 JBS&G

0 45 90 180 m

Scale: 1:5,000

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date
A3			
A	R01	BC	16-03-2018

Legend:

Approximate Site Boundary

JBS&G **Historical Aerial 1975**

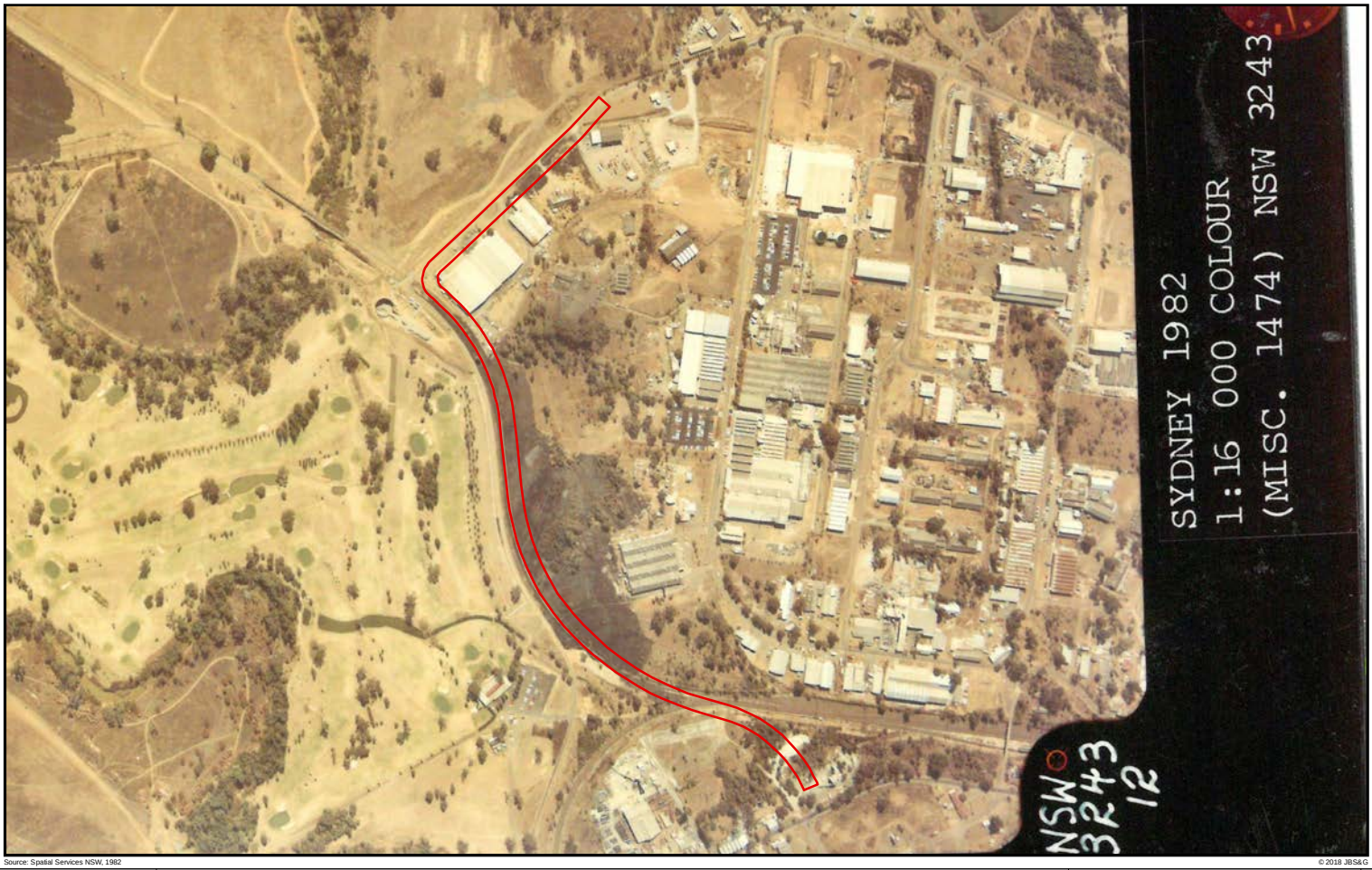
Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_1975

N

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018



Source: Spatial Services NSW, 1982

© 2018 JBS&G

0 45 90 180 m

Scale: 1:5,000

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date
A3			
A	R01	BC	16-03-2018

Legend:
Approximate Site Boundary

JBS&G **Historical Aerial 1982**

Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_1982

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018



Source: Spatial Services NSW, 1991

© 2018 JBS&G

0 45 90 180 m

Scale: 1:5,000

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date
A3			
A	R01	BC	16-03-2018

Legend:

Approximate Site Boundary

JBS&G **Historical Aerial 1991**

Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_1991

N

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018



Source: Google Earth Imagery, 2002.

© 2018 JBS&G

0 45 90 180 m

Scale: 1:5,000

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date
A3			
A	R01	BC	16-03-2018

Legend:

Approximate Site Boundary

JBS&G **Historical Aerial 2002**

Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_2002

N

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018



Source: Nearmap - http://maps.au.nearmap.com/. Imagery 20-10-2009.

© 2018 JBS&G

0 45 90 180 m

Scale: 1:5,000

Datum: GDA 1994 MGA Zone 56 - AHD

A3

Rev	Description	Drn.	Date
A	R01	BC	16-03-2018

Legend:

Approximate Site Boundary

JBS&G **Historical Aerial 2009**

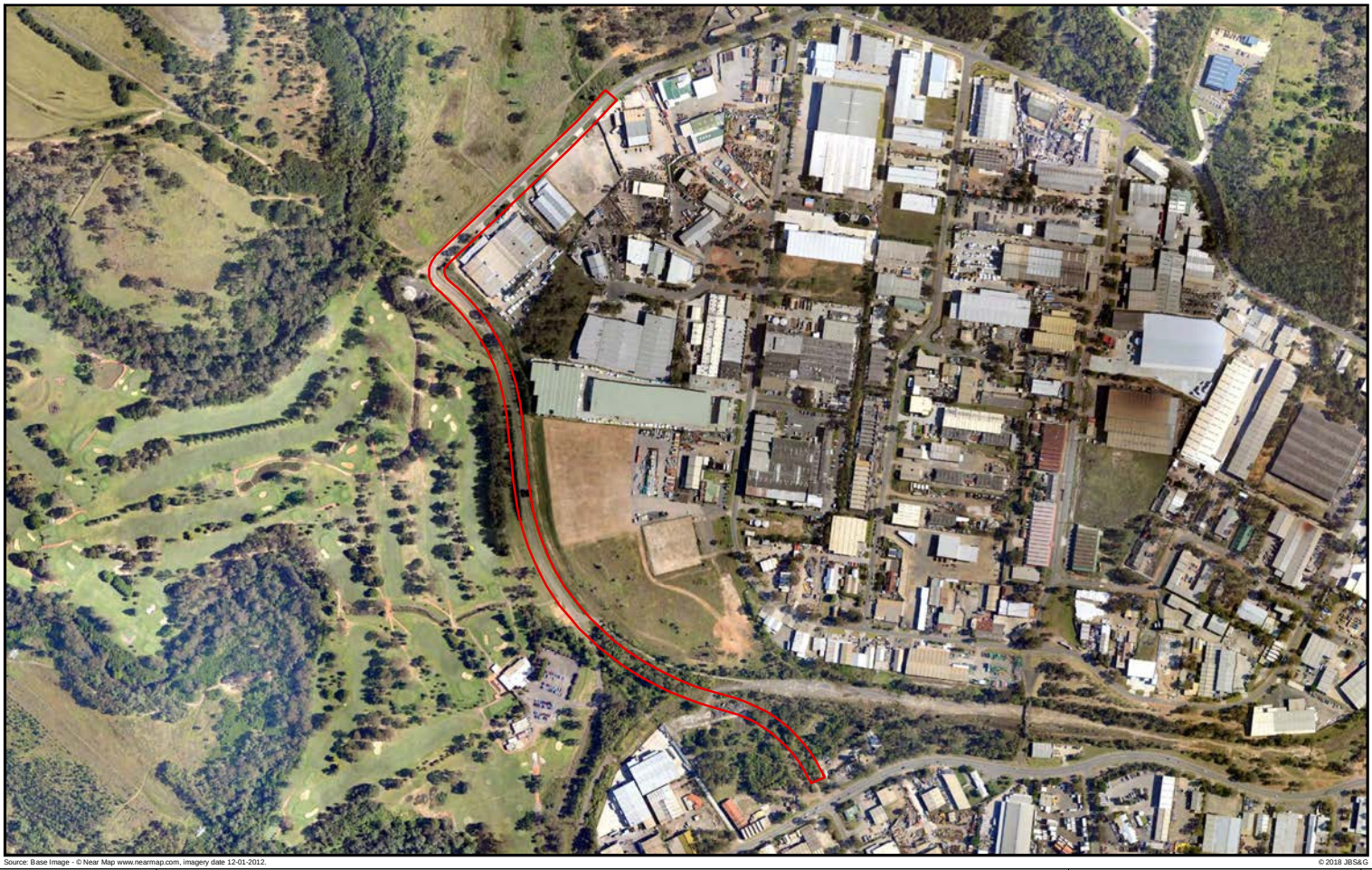
Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_2009

N

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018



Source: Base Image - © Near Map www.nearmap.com, imagery date 12-01-2012.

© 2018 JBS&G

0 45 90 180 m

Scale: 1:5,000

Datum: GDA 1994 MGA Zone 56 - AHD

A3

Rev	Description	Drn.	Date
A	R01	BC	16-03-2018

Legend:

Approximate Site Boundary

JBS&G **Historical Aerial 2012**

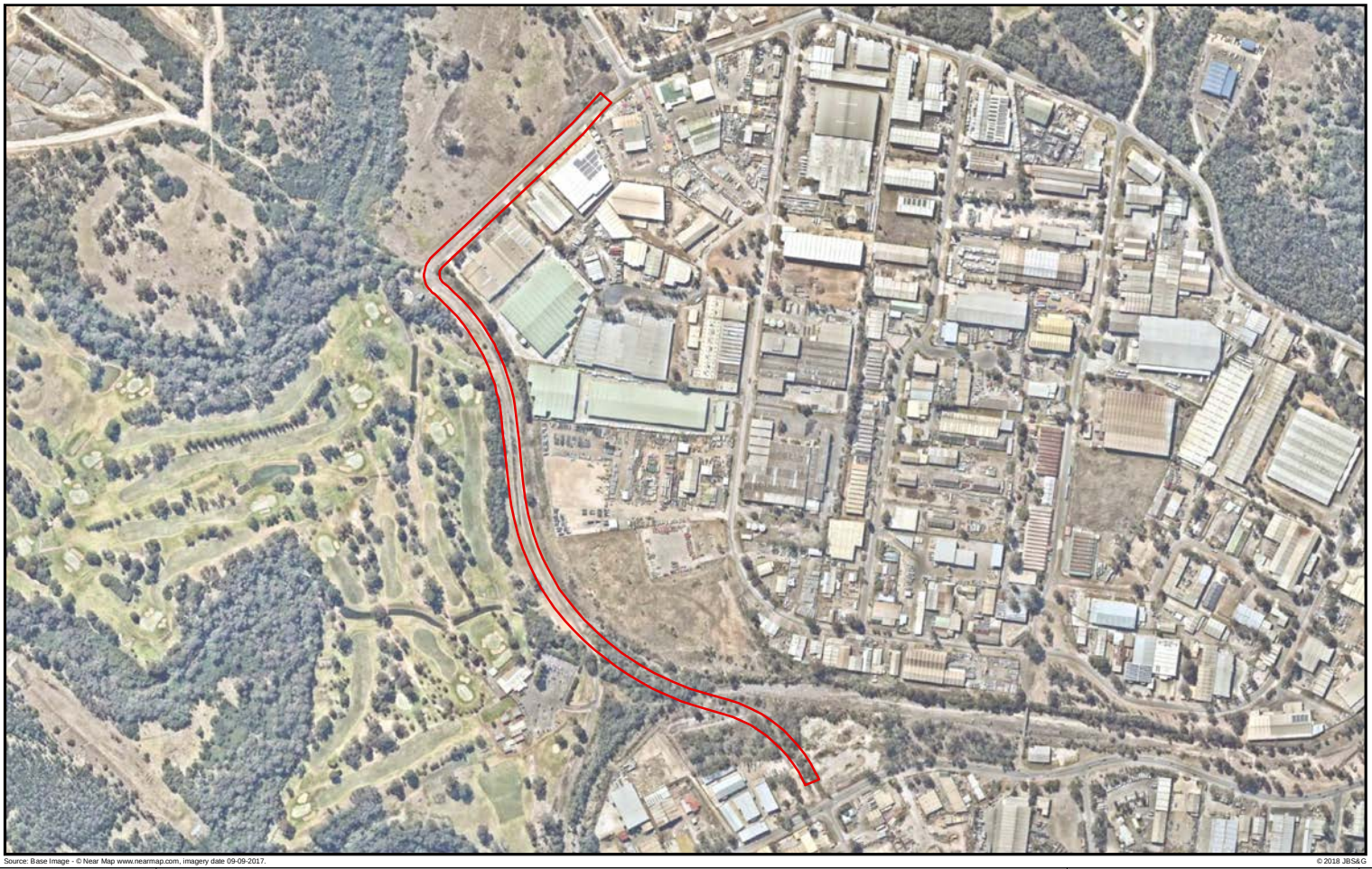
Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_2012

N

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018



Source: Base Image - © Near Map www.nearmap.com, imagery date 09-09-2017.

© 2018 JBS&G

0 45 90 180 m

Scale: 1:5,000

Datum: GDA 1994 MGA Zone 56 - AHD

A3

Rev	Description	Drn.	Date
A	R01	BC	16-03-2018

Legend:

Approximate Site Boundary

JBS&G **Historical Aerial 2017**

Client: Marylands Development Company

Project: Central Precinct

Job No: 54340 File Name: 54340_2017

N

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Appendix D EPA and Heritage Search Results

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Number	Name	Location	Type	Status	Issued date
11508	ABLEWAY WASTE MANAGEMENT PTY LTD	DP734445 Lot 2 37-55 Lee Holm Road, ST MARYS, NSW 2760	POEO licence	Surrendered	31-Aug-01
1031002	ABLEWAY WASTE MANAGEMENT PTY LTD	DP734445 Lot 2 37-55 Lee Holm Road, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	2-Oct-03
1034286	ABLEWAY WASTE MANAGEMENT PTY LTD	DP734445 Lot 2 37-55 Lee Holm Road, ST MARYS, NSW 2760	s.110 Revocation of Clean Up Notice	Issued	30-Jan-04
4289	ARCADIA PRODUCTS PTY LTD	1 BENT STREET, ST MARYS, NSW 2760	POEO licence	Surrendered	18-Sep-00
1018811	ARCADIA PRODUCTS PTY LTD	1 BENT STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	13-Aug-02
1035	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	POEO licence	Issued	7-Sep-00
1020127	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	19-Sep-02
1057338	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	7-Apr-06
1072216	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	20-Sep-07
1089390	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	30-Jun-08
1090092	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	8-Jul-08
1092524	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	30-Sep-08
1093620	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	4-Nov-08
1101929	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	2-Sep-10
1525808	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	27-Oct-14
1552517	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	5-Jun-17
1552979	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	9-Jun-17
1553543	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	29-Jun-17
1556139	AUTOPAK-VETLAB GROUP PTY. LIMITED	39 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	29-Aug-17
20667	AWESOME RUBBER PTY LIMITED	39-45 VALLANCE ST, ST MARYS, NSW 2760	POEO licence	Pending	
11963	BETTER DRUMS PTY LTD	42 PLASSER CRESCENT, ST MARYS, NSW 2760	POEO licence	Surrendered	1-Aug-03
1031980	BETTER DRUMS PTY LTD	42 PLASSER CRESCENT, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	23-Oct-03
1039029	BETTER DRUMS PTY LTD	42 PLASSER CRESCENT, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	29-Jul-05

1176	BORAL RESOURCES (NSW) PTY LTD	136 CHRISTIE STREET, ST MARYS, NSW 2760	POEO licence	No longer in force	30-May-00
5973	BRANDSTER SERVICES PTY LIMITED	UNIT 4, 5, 6 & 7; 15 LEE HOLM ROAD, ST MARYS, NSW 2760	POEO licence	Issued	17-Mar-00
1027390	BRANDSTER SERVICES PTY LIMITED	UNIT 4, 5, 6 & 7; 15 LEE HOLM ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	1-Aug-03
1031041	BRANDSTER SERVICES PTY LIMITED	UNIT 4, 5, 6 & 7; 15 LEE HOLM ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	22-Sep-03
1059072	BRANDSTER SERVICES PTY LIMITED	UNIT 4, 5, 6 & 7; 15 LEE HOLM ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	11-May-06
1093341	BRANDSTER SERVICES PTY LIMITED	UNIT 4, 5, 6 & 7; 15 LEE HOLM ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	11-Nov-08
1113513	BRANDSTER SERVICES PTY LIMITED	UNIT 4, 5, 6 & 7; 15 LEE HOLM ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	3-Jun-10
7082	BRAZIER GROUP PTY. LIMITED	32 BENT STREET, ST MARYS, NSW 2760	POEO licence	Surrendered	14-Sep-01
1018607	BRAZIER GROUP PTY. LIMITED	32 BENT STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	9-Aug-02
1025029	BRAZIER GROUP PTY. LIMITED	32 BENT STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	20-Feb-03
1035157	BRAZIER GROUP PTY. LIMITED	32 BENT STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	22-Sep-04
1064545	BRAZIER GROUP PTY. LIMITED	32 BENT STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	23-Oct-06
1072003	BRAZIER GROUP PTY. LIMITED	32 BENT STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	27-Apr-07
1096965	BRAZIER GROUP PTY. LIMITED	32 BENT STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	13-Feb-09
1110650	BRAZIER GROUP PTY. LIMITED	32 BENT STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	15-Jan-10
2131	CHEMCOLOUR INDUSTRIES AUSTRALIA PTY LIMITED	19-25 ANNE STREET, ST MARYS, NSW 2760	POEO licence	Issued	14-Oct-99
1020114	CHEMCOLOUR INDUSTRIES AUSTRALIA PTY LIMITED	19-25 ANNE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	12-Sep-02
1079932	CHEMCOLOUR INDUSTRIES AUSTRALIA PTY LIMITED	19-25 ANNE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	6-Nov-07
1106736	CHEMCOLOUR INDUSTRIES AUSTRALIA PTY LIMITED	19-25 ANNE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	30-Aug-10

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1510383	CHEMCOLOUR INDUSTRIES AUSTRALIA PTY LIMITED	19-25 ANNE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	29-Nov-12
1548315	CHEMCOLOUR INDUSTRIES AUSTRALIA PTY LIMITED	19-25 ANNE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	2-Feb-17
1553224	CHEMCOLOUR INDUSTRIES AUSTRALIA PTY LIMITED	19-25 ANNE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	16-Jun-17
5479	CLEANAWAY PTY LTD	562-568 MAMRE RD, ST MARYS, NSW 2760	POEO licence	Surrendered	7-Sep-00
3085773635	CMA ECOCYCLE PTY LTD	52-54 POWER STREET, ST MARYS, NSW 2760	Penalty Notice	Withdrawn	
11753	CMA ECOCYCLE PTY LTD	52-54 POWER STREET, ST MARYS, NSW 2760	POEO licence	Surrendered	18-Oct-02
1048527	CMA ECOCYCLE PTY LTD	52-54 POWER STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	8-Jun-05
1078499	CMA ECOCYCLE PTY LTD	52-54 POWER STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	26-Sep-07
1093335	CMA ECOCYCLE PTY LTD	52-54 POWER STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	22-Jun-09
1520718	CMA ECOCYCLE PTY LTD	52-54 POWER STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	12-Mar-14
3027	CNH AUSTRALIA PTY LTD	31-53 KURRAJONG AVE, ST MARYS, NSW 2760	POEO licence	No longer in force	18-Sep-00
1042172	CNH AUSTRALIA PTY LTD	31-53 KURRAJONG AVE, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	9-Nov-04
1043841	CNH AUSTRALIA PTY LTD	31-53 KURRAJONG AVE, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	19-Jan-05
644	CORINTHIAN INDUSTRIES (AUSTRALIA) PTY LIMITED	17-35 LEE HOLM ROAD, ST MARYS, NSW 2760	POEO licence	Surrendered	8-May-00
1020903	CORINTHIAN INDUSTRIES (AUSTRALIA) PTY LIMITED	17-35 LEE HOLM ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	30-Sep-02

20292	GULF WESTERN PREMIUM QUALITY LUBRICATING OILS (AUSTRALIA) PTY LIMITED	92-96 Links Road, ST MARYS, NSW 2760	POEO licence	Issued	12-Jun-13
10562	HI-QUALITY WASTE MANAGEMENT PTY LTD	55 Lee Holm Road, ST MARYS, NSW 2760	POEO licence	Surrendered	20-Mar-00
5857	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	POEO licence	Issued	19-Sep-00
1008683	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	12-Sep-01
1016576	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	22-Apr-02
1046028	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	3-May-05
1096760	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	21-Jan-09
1124838	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	1-Mar-11
1126196	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	22-Mar-11
1128245	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	31-May-11
1500636	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.110 Variation of Clean Up Notice	Issued	2-Sep-11
3085765037	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	Penalty Notice	Issued	7-Aug-12
3085765046	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	Penalty Notice	Issued	7-Aug-12
1507633	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	15-Aug-12
1511551	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.110 Variation of Clean Up Notice	Issued	22-Feb-13

3085773745	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	Penalty Notice	Issued	14-Apr-14
1521897	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	12-Dec-14
1530683	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	15-Jun-15
1535841	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	24-Nov-15
3085778127	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	Penalty Notice	Issued	15-Feb-16
1532262	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	7-Apr-16
1539046	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.110 Variation of Clean Up Notice	Issued	6-May-16
1546677	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.110 Variation of Clean Up Notice	Issued	18-Jan-17
3085781243	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	Penalty Notice	Issued	21-Feb-17
3085782590	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	Penalty Notice	Issued	14-Jun-17
3085782619	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	Penalty Notice	Issued	14-Jun-17
3085782545	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	Penalty Notice	Issued	14-Jun-17
1541749	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	26-Oct-17
3173524265	HI-QUALITY WASTE MANAGEMENT PTY LTD	37 LEE HOLM STREET, ST MARYS, NSW 2760	Penalty Notice	Issued	21-Dec-17
3445	HY-TEC INDUSTRIES PTY LTD	12 LINKS ROAD, ST MARYS, NSW 2760	POEO licence	No longer in	22-Sep-00
1012028	HY-TEC INDUSTRIES PTY LTD	12 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	26-Nov-01
20640	J.J. RICHARDS & SONS PTY LTD	8 Kommer Place , ST MARYS, NSW 2760	POEO licence	Issued	9-Feb-16

1540293	Maganic Brothers and Sister Pty Limited	65 Dunheved Cct, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	16-May-16
1527949	Nabil Magar	11 Severn Street, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	19-Jan-15
4801	PLASTECH OPERATIONS PTY LIMITED (C/- MICHAEL C HIRD - ADMINISTRATOR)	66 LINKS ROAD, ST MARYS, NSW 2760	POEO licence	Revoked	13-Jun-00
1030570	PLASTECH OPERATIONS PTY LIMITED (C/- MICHAEL C HIRD - ADMINISTRATOR)	66 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	23-Sep-03
1067060	PLASTECH OPERATIONS PTY LIMITED (C/- MICHAEL C HIRD - ADMINISTRATOR)	66 LINKS ROAD, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	1-Dec-06
1063241	PLASTECH OPERATIONS PTY LIMITED (C/- MICHAEL C HIRD - ADMINISTRATOR)	66 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	7-Feb-07
1070032	PLASTECH OPERATIONS PTY LIMITED (C/- MICHAEL C HIRD - ADMINISTRATOR)	66 LINKS ROAD, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	7-Mar-07
1082788	PLASTECH OPERATIONS PTY LIMITED (C/- MICHAEL C HIRD - ADMINISTRATOR)	66 LINKS ROAD, ST MARYS, NSW 2760	s.79 Revocation of a Licence	Issued	26-Feb-08
11688	PYRMONT RAW MATERIALS PTY LTD	OFF CHRISTIE STREET, ST MARYS, NSW 2760	POEO licence	Revoked	21-Feb-03
1060364	PYRMONT RAW MATERIALS PTY LTD	OFF CHRISTIE STREET, ST MARYS, NSW 2760	s.79 Revocation of a Licence	Issued	19-May-06
21048	Ram Almola	84 Dunheved Circuit, ST MARYS, NSW 2760	POEO licence	Pending	
13365	SAMOS POLYMERS PTY LTD	26 Links Road, ST MARYS, NSW 2760	POEO licence	Issued	25-May-11
13295	SAMOS POLYMERS PTY LTD	9-15 Kommer Place, ST MARYS, NSW 2760	POEO licence	Issued	25-May-11
1509520	SAMOS POLYMERS PTY LTD	9-15 Kommer Place, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	23-Oct-12
2494	SI GROUP-AUSTRALIA PTY LIMITED	72 CHRISTIE STREET, ST MARYS, NSW 2760	POEO licence	Surrendered	1-May-00
1044213	SI GROUP-AUSTRALIA PTY LIMITED	72 CHRISTIE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	3-Feb-05

1093908	SI GROUP-AUSTRALIA PTY LIMITED	72 CHRISTIE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	2-Jul-09
1504267	SI GROUP-AUSTRALIA PTY LIMITED	72 CHRISTIE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	10-Feb-12
2017	SIMS ALUMINIUM PTY LIMITED	42-46 CHARLES STREET, ST MARYS, NSW 2760	POEO licence	Surrendered	4-Apr-00
6934	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	POEO licence	Issued	30-Oct-00
1018948	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	s.58 Licence Variation	Issued	13-Aug-02
1055296	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	s.58 Licence Variation	Issued	13-Jan-06
1057381	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	s.58 Licence Variation	Issued	18-Aug-08
1092273	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	s.58 Licence Variation	Issued	25-Sep-09
1110266	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	s.58 Licence Variation	Issued	16-Mar-10
1123950	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	s.58 Licence Variation	Issued	2-Feb-11
1500478	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	s.58 Licence Variation	Issued	22-Aug-11
1501437	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	s.58 Licence Variation	Issued	5-Sep-11
1509111	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	s.58 Licence Variation	Issued	21-Nov-12
1518434	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	Compliance Audit	Complete	22-Nov-13
1512642	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	Compliance Audit	Complete	13-Mar-14

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1557778	SIMS GROUP AUSTRALIA HOLDINGS LIMITED	76 - 100 CHRISTIE STREET , ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	18-Oct-17
5661	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	POEO licence	Issued	7-Mar-01
1049649	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.96 Prevention Notice	Issued	21-Jul-05
1049570	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	16-Dec-05
1056021	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	8-Feb-06
1058789	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	1-Jun-06
1064844	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	12-Sep-06
1068248	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	24-Jan-07
1082534	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	24-Mar-08
1093340	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	3-Dec-08
1096018	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	19-Dec-08
1097934	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	27-Mar-09
1113282	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	5-May-10
1122575	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	13-Jul-11
1502905	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.96 Prevention Notice	Issued	24-Nov-11
1504531	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	29-Feb-12
1506751	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	26-Jun-12
1512382	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	26-Feb-13
1522629	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	12-Nov-14
1554878	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	1-Aug-17
3173523257	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	Penalty Notice	Issued	5-Sep-17
1554973	SOLVECO PTY LIMITED	38 LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	16-Oct-17
20621	ST MARYS RECYCLING PTY LTD	25 Dunheved Cct, ST MARYS, NSW 2760	POEO licence	Issued	9-Oct-15
2052	SUPERIOR CONSTRUCTION MATERIALS PTY LIMITED	17 BENT STREET, ST MARYS, NSW 2760	POEO licence	Surrendered	22-Sep-99
1099868	SYDNEY DRUM MACHINERY PTY LTD	75 CHRISTIE ST, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	20-May-09
1106659	SYDNEY DRUM MACHINERY PTY LTD	75 CHRISTIE ST, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	9-Nov-09
1126545	SYDNEY DRUM MACHINERY PTY LTD	75 CHRISTIE ST, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	20-Apr-11
1501637	SYDNEY DRUM MACHINERY PTY LTD	75 CHRISTIE ST, ST MARYS, NSW 2760	s.79 Suspension of a Licence	Issued	5-Oct-11
1502921	SYDNEY DRUM MACHINERY PTY LTD	75 CHRISTIE ST, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	25-Nov-11

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1503352	SYDNEY DRUM MACHINERY PTY LTD	75 CHRISTIE ST, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	16-Dec-11
1503772	SYDNEY DRUM MACHINERY PTY LTD	75 CHRISTIE ST, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	17-Jan-12
1503835	SYDNEY DRUM MACHINERY PTY LTD	75 CHRISTIE ST, ST MARYS, NSW 2760	s.110 Variation of Clean Up	Issued	19-Jan-12
1503916	SYDNEY DRUM MACHINERY PTY LTD	75 CHRISTIE ST, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	24-Jan-12
12893	SYDNEY DRUM MACHINERY PTY LTD	75 CHRISTIE ST, ST MARYS, NSW 2760	POEO licence	Surrendered	3-May-13
20767	SYDNEY TYRE RECYCLING PTY LTD	98-102 Links Road, ST MARYS, NSW 2760	POEO licence	Issued	7-Feb-18
1729	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	POEO licence	Issued	25-May-00
1005322	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	22-Oct-01
1017903	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	26-Jun-02
1018901	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	23-Dec-02
1032532	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	24-Nov-03
1032870	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	19-Mar-04
1047588	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	30-Jun-05
1061415	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	29-Jun-06
1074761	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	27-Jun-07
13210	SYDNEY WATER CORPORATION	Gate 4, Links Road, ST MARYS, NSW 2760	POEO licence	Issued	25-Feb-10
1116215	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	2-Jul-10
1129008	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	23-Jun-11
1504849	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	28-Jun-12
1528930	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	23-Mar-15
1538190	SYDNEY WATER CORPORATION	OFF LINKS ROAD, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	19-Feb-16
21011	THE COBRA GROUP (AUST) PTY LTD	30-32 Bent Street, ST MARYS, NSW 2760	POEO licence	Pending	
12628	TOX FREE AUSTRALIA PTY LTD	40 CHRISTIE STREET, ST MARYS, NSW 2760	POEO licence	Issued	4-Jan-07
12943	TOX FREE AUSTRALIA PTY LTD	66 Links Road, ST MARYS, NSW 2760	POEO licence	Issued	6-Aug-08
1095209	TOX FREE AUSTRALIA PTY LTD	66 Links Road, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	24-Nov-08
1093336	TOX FREE AUSTRALIA PTY LTD	40 CHRISTIE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	28-Nov-08
1101806	TOX FREE AUSTRALIA PTY LTD	40 CHRISTIE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	16-Jun-09

1120636	TOX FREE AUSTRALIA PTY LTD	40 CHRISTIE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	9-Nov-10
20271	TOX FREE AUSTRALIA PTY LTD	42-46 CHARLES STREET, ST MARYS, NSW 2760	POEO licence	Issued	26-Sep-13
1521195	TOX FREE AUSTRALIA PTY LTD	66 Links Road, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	4-Apr-14
1522845	TOX FREE AUSTRALIA PTY LTD	40 CHRISTIE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	18-Jun-14
1556548	TOX FREE AUSTRALIA PTY LTD	40 CHRISTIE STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Pending	28-Aug-17
3173524247	TOX FREE AUSTRALIA PTY LTD	42-46 CHARLES STREET, ST MARYS, NSW 2760	Penalty Notice	Issued	12-Jan-18
1536335	TRUEGAIN PTY. LIMITED	38 Charles Sreet, ST MARYS, NSW 2760	s.91 Clean Up Notice	Issued	15-Jan-16
3085779346	TRUEGAIN PTY. LIMITED	38 Charles Sreet, ST MARYS, NSW 2760	Penalty Notice	Issued	29-Apr-16
13217	TYRECYCLE PTY LTD	81-85 Christie Street, ST MARYS, NSW 2760	POEO licence	Issued	21-Jun-10
1535929	TYRECYCLE PTY LTD	81-85 Christie Street, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	21-Dec-15
4452	VETLAB PTY. LIMITED	25 HARRIS STREET, ST MARYS, NSW 2760	POEO licence	Surrendered	20-Apr-00
1020129	VETLAB PTY. LIMITED	25 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	10-Sep-02
1057333	VETLAB PTY. LIMITED	25 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	7-Apr-06
1072505	VETLAB PTY. LIMITED	25 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	19-Sep-07
1120813	VETLAB PTY. LIMITED	25 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	1-Nov-10
1525407	VETLAB PTY. LIMITED	25 HARRIS STREET, ST MARYS, NSW 2760	s.58 Licence Variation	Issued	23-Oct-14

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List of NSW Contaminated Sites Notified to EPA as of 9 February 2018

Background

A strategy to systematically assess, prioritise and respond to notifications under Section 60 of the *Contaminated Land Management Act 1997* (CLM Act) has been developed by the EPA. This strategy acknowledges the EPA's obligations to make information available to the public under *Government Information (Public Access) Act 2009*.

When a site is notified to the EPA, it may be accompanied by detailed site reports where the owner has been proactive in addressing the contamination and its source. However, often there is minimal information on the nature or extent of the contamination.

For some notifications, the information indicates the contamination is securely immobilised within the site, such as under a building or carpark, and is not currently causing any offsite consequences to the community or environment. Such sites would still need to be cleaned up, but this could be done in conjunction with any subsequent building or redevelopment of the land. These sites may not require intervention under the CLM Act, but could be dealt with through the planning and development consent process.

Where indications are that the nominated site is causing actual harm to the environment or an unacceptable offsite impact (i.e. it is a "significantly contaminated site"), the EPA would apply the regulatory provisions of the CLM Act to have the responsible polluter and/or landowner investigate and remediate the site.

As such, the sites notified to the EPA and presented in the following table are at various stages of the assessment and/or remediation process. Understanding the nature of the underlying contamination, its implications and implementing a remediation program where required, can take a considerable period of time. The tables provide an indication, in relation to each nominated site, as to the management status of that particular site. Further detailed information may be available from the EPA or the responsible landowner.

The following questions and answers may assist those interested in this issue:

Frequently asked questions

What is the difference between the "List of NSW Contaminated Sites Notified to the EPA" and the "Contaminated Land: Record of Notices"?

A site will be on the Contaminated Land: Record of Notices only if the EPA has issued a regulatory notice in relation to the site under the *Contaminated Land Management Act 1997*.

The sites appearing on this "List of NSW contaminated sites notified to the EPA" indicate that the notifiers consider that the sites are contaminated and warrant reporting to the EPA. However, the contamination may or may not be significant enough to warrant regulation by the EPA. The EPA needs to review and, if necessary, obtain more information before it can make a determination as to whether the site warrants regulation.

Why my site appears on the list?

Your site appears on the list because of one or more of the following reasons:

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- The site owner and/or the person partly or fully responsible for causing the contamination notified to the EPA about the contamination under Section 60 of the *Contaminated Land Management Act 1997*. In other words, the site owner or the "polluter" believes the site is contaminated.
- The EPA has been notified via other means and is satisfied that the site is or was contaminated.

Does the list contain all contaminated sites in NSW?

No. The list only contains contaminated sites that the EPA is aware of, with regard to its regulatory role under the CLM Act. An absence of a site from the list does not necessarily imply the site is not contaminated.

The EPA relies upon responsible parties to notify contaminated sites.

How are these notified contaminated sites managed by the EPA?

There are different ways that the EPA manages these notified contaminated sites. First, an initial assessment is carried out by the EPA. At the completion of the initial assessment, the EPA may take one or more than one of the following management approaches:

- The contamination warrants the EPA's direct regulatory intervention either under the *Contaminated Land Management Act 1997* or the *Protection of the Environment Operations Act 1997* (POEO Act), or both. Information about current or past regulatory action on this site can be found on EPA website.
- The contamination with respect to the current use or approved use of the site, as defined under the *Contaminated Land Management Act 1997,* is not significant enough that it warrants EPA regulation.
- The contamination does not require EPA regulation and can be managed by a planning approval process.
- The contamination is related to an operational Underground Petroleum Storage System, such as a service station or fuel depot. The contamination may be managed under the POEO Act and the Protection of the Environment Operation (Underground Petroleum Storage Systems) Regulation 2008.
- The contamination is being managed under a specifically tailored program operated by another agency (for example the Department of Industry and Investment's *Derelict Mines Program*).

I am the owner of a site that appears on the list. What should I do?

First of all, you should ensure the current use of the site is compatible with the site contamination. Secondly, if the site is the subject of EPA regulation, make sure you comply with the regulatory requirements, and you have considered your obligations to notify other parties who may be affected.

If you have any concerns, contact us and we may be able to offer you general advice, or direct you to accredited professionals who can assist with specific issues.

I am a prospective buyer of a site that appears on the list. What should I do?

You should seek advice from the vendor to put the contamination issue into perspective. You may need to seek independent expert advice.

The information provided in the list is meant to be indicative only, and a starting point for your own assessment. Site contamination as a legacy of past site uses is not uncommon,

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particularly in an urbanised environment. If the contamination on a site is properly remediated or managed, it may not materially impact upon the intended future use of the site. However, each site needs to be considered in context.

List of NSW Contaminated Sites Notified to the EPA

Disclaimer

The EPA has taken all reasonable care to ensure that the information in the list of contaminated sites notified to the EPA (the list) is complete and correct. The EPA does not, however, warrant or represent that the list is free from errors or omissions or that it is exhaustive.

The EPA may, without notice, change any or all of the information in the list at any time.

You should obtain independent advice before you make any decision based on the information in the list.

The list is made available on the understanding that the EPA, its servants and agents, to the extent permitted by law, accept no responsibility for any damage, cost, loss or expense incurred by you as a result of:

1. any information in the list; or
2. any error, omission or misrepresentation in the list; or
3. any malfunction or failure to function of the list;
4. without limiting (2) or (3) above, any delay, failure or error in recording, displaying or updating information.

Site Status	Explanation
Under assessment	The contamination is being assessed by the EPA to determine whether regulation is required. The EPA may require further information to complete the assessment. For example, the completion of management actions regulated under the planning process or *Protection of the Environment Operations Act 1997*. Alternatively, the EPA may require information via a notice issued under s77 of the *Contaminated Land Management Act 1997* or issue a Preliminary Investigation Order.
Regulation under CLM Act not required	The EPA has completed an assessment of the contamination and decided that regulation under the *Contaminated Land Management Act 1997* is not required.
Regulation being finalised	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the *Contaminated Land Management Act 1997*. A regulatory approach is being finalised.

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Contamination currently regulated under CLM Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the *Contaminated Land Management Act 1997* (CLM Act). Management of the contamination is regulated by the EPA under the CLM Act. Regulatory notices are available on the EPA's Contaminated Land Public Record.
Contamination currently regulated under POEO Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. Management of the contamination is regulated under the *Protection of the Environment Operations Act 1997* (POEO Act). The EPA's regulatory actions under the POEO Act are available on the POEO public register.
Contamination being managed via the planning process (EP&A Act)	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. The contamination of this site is managed by the consent authority under the *Environmental Planning and Assessment Act 1979* (EP&A Act) planning approval process, with EPA involvement as necessary to ensure significant contamination is adequately addressed. The consent authority is typically a local council or the Department of Planning and Environment.
Contamination formerly regulated under the CLM Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation under the *Contaminated Land Management Act 1997* (CLM Act). The contamination was addressed under the CLM Act.
Contamination formerly regulated under the POEO Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed under the *Protection of the Environment Operations Act 1997* (POEO Act).
Contamination was addressed via the planning process (EP&A Act)	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed by the appropriate consent authority via the planning process under the *Environmental Planning and Assessment Act 1979* (EP&A Act).
Ongoing maintenance required to manage residual contamination (CLM Act)	The EPA has determined that ongoing maintenance, under the *Contaminated Land Management Act 1997* (CLM Act), is required to manage the residual contamination. Regulatory notices under the CLM Act are available on the EPA's Contaminated Land Public Record.

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Suburb	Site Name	Site Address	Contamination Activity Type	EPA Management Class	Latitude	Longitude
SILVERWATER	Vacant property	103-105 Silverwater ROAD	Other Industry	Regulation under CLM Act not required	-33.83831374	151.0472576
SILVERWATER	Former Printing Facility	46-58 Derby STREET	Unclassified	Under assessment	-33.83855869	151.0478649
SILVERWATER	Storage Facility	54-58 Derby STREET	Unclassified	Under assessment	-33.83855869	151.0478649
SILVERWATER	Silverwater Landfill	Carnarvon ROAD	Landfill	Regulation under CLM Act not required	-33.83506394	151.033214
SINGLETON	Putty Saw Mill	(via Singleton) Putty ROAD	Unclassified	Contamination currently regulated under CLM Act	-32.99958725	150.7111684
SINGLETON	BP Service Station Singleton	53 George (Cnr Macquarie St) STREET	Other Petroleum	Regulation under CLM Act not required	-32.56182325	151.1748054
SINGLETON	Singleton Gasworks	55-57 John STREET	Gasworks	Contamination currently regulated under CLM Act	-32.56774715	151.1658188
SINGLETON	NSW Mines Rescue Services - Singleton	6 Lachlan AVENUE	Other Industry	Regulation under CLM Act not required	-32.54537821	151.156584
SINGLETON	Shell Coles Express Service Station	69-73 George STREET	Service Station	Regulation under CLM Act not required	-32.56297156	151.1755215
SINGLETON	Mobil Singleton Airport Elt	74B Range ROAD	Other Petroleum	Regulation under CLM Act not required	-32.60270846	151.1944828
SINGLETON	Bulga Surface Operations	Broke ROAD	Other Industry	Regulation under CLM Act not required	-32.68325751	151.1206158
SMITHFIELD	Freestones	1 Hume ROAD	Other Petroleum	Regulation under CLM Act not required	-33.83577694	150.9310112
SMITHFIELD	Liquip International	13 Hume ROAD	Other Industry	Under assessment	-33.83802635	150.9319034
SMITHFIELD	Caltex Smithfield	16-18 Tait STREET	Service Station	Regulation under CLM Act not required	-33.84596441	150.9435497
SMITHFIELD	Coles Express (former Mobil) Service Station	678 The Horsley Drive, corner Smithfield ROAD	Service Station	Regulation under CLM Act not required	-33.85376154	150.9400104
SMITHFIELD	Former Landfill	Little STREET	Landfill	Contamination being managed via the planning process (EP&A Act)	-33.85025253	150.9411561
SOUTH ALBURY	BP Border Service Station	Corner Ebden Street and Wodonga PLACE	Service Station	Contamination currently regulated under CLM Act	-36.08875942	146.9093882
SOUTH BOWENFELS	Shell Coles Express Service Station	Lot 1 Great Western HIGHWAY	Service Station	Regulation under CLM Act not required	-33.50589001	150.1238487
SOUTH COOGEE	Caltex South Coogee Service Station	169-173 Malabar ROAD	Service Station	Regulation under CLM Act not required	-33.93233184	151.2574377
SOUTH GRAFTON	Former Caltex Service Station	46-58 Schwinghammer STREET	Service Station	Regulation under CLM Act not required	-29.71128273	152.9458313
SOUTH GRAFTON	Former Caltex Depot South Grafton	72-82 Swallow ROAD	Other Petroleum	Regulation under CLM Act not required	-29.73168549	152.944024
SOUTH GRAFTON	Shell Coles Express Service Station	91 Bent STREET	Service Station	Regulation under CLM Act not required	-29.70605829	152.9400329
SOUTH GRAFTON	Former United (former Mobil) Service Station	Corner Pacific Highway and Charles STREET	Service Station	Regulation under CLM Act not required	-29.70814828	152.9412928
SOUTH GRAFTON	Caltex Service Station	Pacific Hwy Cnr Gwyder HIGHWAY	Service Station	Regulation under CLM Act not required	-29.70739015	152.9425508

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Suburb	Site Name	Site Address	Contamination Activity Type	EPA Management Class	Latitude	Longitude
SOUTH KEMPSEY	Caltex Service Station	52 Lachlan STREET	Service Station	Regulation under CLM Act not required	-31.09361084	152.8370796
SOUTH LISMORE	Former Mobil Service Station	126 - 128 Union STREET	Service Station	Regulation under CLM Act not required	-28.81242175	153.267541
SOUTH LISMORE	North Coast Petroleum (Former Mobil) Depot Lismore	19-21 Elliot ROAD	Other Petroleum	Regulation under CLM Act not required	-28.81212046	153.2661935
SOUTH LISMORE	Caltex Service Station	237 Union STREET	Service Station	Regulation under CLM Act not required	-28.82052708	153.2648111
SOUTH LISMORE	Former Mobil Depot	26-32 Phyllis STREET	Other Petroleum	Regulation under CLM Act not required	-28.81005206	153.2660073
SOUTH MURWILLUMBAH	Caltex Service Station	1-7 Buchanan (Cnr Tweed Valley Way) STREET	Service Station	Regulation under CLM Act not required	-28.32687988	153.4093274
SOUTH MURWILLUMBAH	Former Caltex Depot	39 Lundberg DRIVE	Service Station	Regulation under CLM Act not required	-28.332622	153.4212884
SOUTH MURWILLUMBAH	Former Mobil Depot	45 Wardrop STREET	Other Petroleum	Regulation under CLM Act not required	-28.33421395	153.3993772
SOUTH NOWRA	Caltex South Nowra	100 Princes HIGHWAY	Service Station	Regulation under CLM Act not required	-34.90516081	150.6029621
SOUTH PENRITH	7-Eleven Service Station	45 Aspen STREET	Service Station	Regulation under CLM Act not required	-33.77727694	150.7107228
SOUTH TAMWORTH	Caltex Service Station	2 Kathleen Street, corner Kent STREET	Service Station	Regulation under CLM Act not required	-31.10361712	150.9186343
SOUTH WENTWORTHVILLE	Caltex Service Station	313 Great Western HIGHWAY	Service Station	Regulation under CLM Act not required	-33.81643692	150.9718802
SOUTH WENTWORTHVILLE	Aldi Stores Development	331-339 Great Western HIGHWAY	Metal Industry	Regulation under CLM Act not required	-33.81605854	150.9697429
SOUTH WEST ROCKS	Former Shell Trial Bay Depot	Phillip DRIVE	Other Petroleum	Regulation under CLM Act not required	-30.89273836	153.0612772
SOUTH WEST ROCKS	Former Trial Bay Caltex Depot	Phillip DRIVE	Other Petroleum	Regulation under CLM Act not required	-30.89190078	153.0573056
SOUTH WEST ROCKS	Residential area and Reserve opposite Former Caltex terminal	Phillip DRIVE	Other Petroleum	Regulation under CLM Act not required	-30.89172594	153.0573164
SPRINGVALE	Springvale Colliery	Castlereagh HIGHWAY	Other Industry	Regulation under CLM Act not required	-33.40334736	150.1070462
ST CLAIR	7-Eleven (former Mobil) Service Station	4 Endeavour AVENUE	Service Station	Regulation under CLM Act not required	-33.79430926	150.7885793
ST IVES	7-Eleven (former Mobil) St Ives Service Station	157-159 Mona Vale (Cnr Putarri Ave) ROAD	Service Station	Regulation under CLM Act not required	-33.73265301	151.1563899
ST IVES	Caltex Service Station	164 Mona Vale ROAD	Service Station	Regulation under CLM Act not required	-33.7307595	151.1570462
ST IVES	Shell Service Station	179-181 Mona Vale ROAD	Service Station	Contamination currently regulated under CLM Act	-33.73124859	151.1575827
ST IVES	Caltex Service Station	363 Mona Vale ROAD	Service Station	Regulation under CLM Act not required	-33.7168971	151.1735263
ST IVES	Caltex Service Station	452 Mona Vale ROAD	Service Station	Regulation under CLM Act not required	-33.70752272	151.187545

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Suburb	Site Name	Site Address	Contamination Activity Type	EPA Management Class	Latitude	Longitude
ST MARYS	Former Woolworths Service Station	120-128 Forrester ROAD	Service Station	Regulation under CLM Act not required	-33.75525115	150.7752897
ST MARYS	Chemcolour Industries Ltd	19-25 Anne STREET	Chemical Industry	Under assessment	-33.75027071	150.7725397
ST MARYS	7-Eleven (former Mobil) Service Station	2 Christie STREET	Service Station	Regulation under CLM Act not required	-33.74790843	150.7767667
ST MARYS	7-Eleven (former Mobil) Service Station	2 Wilson STREET	Service Station	Regulation under CLM Act not required	-33.77790415	150.771689
ST MARYS	Integral Energy Mt Druitt Transmission Substation	69 Kurrajong North ROAD	Other Industry	Regulation under CLM Act not required	-33.76376093	150.7921691
ST MARYS	Caltex St Marys Service Station	Wordoo St Cnr Forrester ROAD	Service Station	Regulation under CLM Act not required	-33.75334263	150.7755489
ST PETERS	BP Express Service Station	2 Princes HIGHWAY	Service Station	Regulation under CLM Act not required	-33.90982281	151.1809936
ST PETERS	Cooks River Rail Terminal	20 Canal ROAD	Unclassified	Regulation under CLM Act not required	-33.91943986	151.1726689
ST PETERS	Former Tidyburn Facility	53 Barwon Park ROAD	Chemical Industry	Contamination formerly regulated under the CLM Act	-33.9130091	151.1809912
ST PETERS	Former Industrial Manufacturing Facility (Taubman's Paints)	75 Mary STREET	Other Industry	Regulation under CLM Act not required	-33.91307297	151.1731383
ST PETERS	Camdenville Park	May STREET	Other Industry	Regulation under CLM Act not required	-33.90911815	151.176951
STANMORE	125 Corunna Road	125 Corunna ROAD	Unclassified	Regulation under CLM Act not required	-33.88937382	151.1644589
STRATHFIELD	7-Eleven (former Mobil) Service Station	577 Liverpool ROAD	Service Station	Regulation under CLM Act not required	-33.88736091	151.0743474
STRATHFIELD SOUTH	Former Landfill Site	7-9 Dunlop STREET	Landfill	Regulation under CLM Act not required	-33.89509698	151.0796751
STROUD	Stroud Fuel Supplies (Former Caltex) Service Station	1 Cowper STREET	Service Station	Regulation under CLM Act not required	-32.39092749	151.9563089
SUFFOLK PARK	BP Service Station	207-209 Broken Head ROAD	Service Station	Regulation under CLM Act not required	-28.68800088	153.6083821
SUFFOLK PARK	Suffolk Park dip site	Cnr Broken Head Road & Beech DRIVE	Cattle Dip	Regulation under CLM Act not required	-28.6874242	153.6072824
SURRY HILLS	Woolworths Petrol Surry Hills	475 Cleveland STREET	Service Station	Regulation under CLM Act not required	-33.89203644	151.216217
SURRY HILLS	Former Legion Cabs (Trading) Cooperative	81 & 81A (Formerly 69 - 81) Foveaux STREET	Service Station	Regulation under CLM Act not required	-33.88470082	151.2107944
SURRY HILLS	Ausgrid Road Reserve	Mary STREET	Other Industry	Regulation under CLM Act not required	-33.88292195	151.2095176
SUTHERLAND	United Service Station and Sutherland Reservoir	1 to 3 Oxford STREET	Service Station	Contamination currently regulated under CLM Act	-34.029532	151.0579906
SUTHERLAND	7-Eleven Service Station	693 Old Princes HIGHWAY	Service Station	Regulation under CLM Act not required	-34.02976735	151.0588789
SUTTON FOREST	Coles Express Sutton Forest West	Hume HIGHWAY	Service Station	Regulation under CLM Act not required	-34.60808989	150.2250592

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Suburb	Site Name	Site Address	Contamination Activity Type	EPA Management Class	Latitude	Longitude
SWANSEA	Caltex Service Station	126 Pacific HIGHWAY	Service Station	Regulation under CLM Act not required	-33.08811841	151.6381764
SWANSEA	Swansea 1 - Wastewater Pumping Station	137 and 137a Northcote AVENUE	Other Industry	Under assessment	-33.097742	151.647253
SYDENHAM	SRA Land	117 Railway PARADE	Other Industry	Regulation under CLM Act not required	-33.91560723	151.1656846
SYDENHAM	Sydenham XPT Maintenance Facility	Way STREET	Other Industry	Regulation under CLM Act not required	-33.91698468	151.1614089
SYDNEY	Interpro House (OSP 46581)	447 Kent STREET	Other Petroleum	Regulation under CLM Act not required	-33.87225413	151.204761
SYDNEY OLYMPIC PARK	RMS Western Precinct	14A-14E and 16 Hill ROAD	Other Petroleum	Regulation under CLM Act not required	-33.82239777	151.0758664
SYDNEY OLYMPIC PARK	Haslams Creek South Area 3	At Kronos Hill, Kevin Coombes AVENUE	Landfill	Contamination formerly regulated under the CLM Act	-33.84113059	151.0602966
SYDNEY OLYMPIC PARK	Bicentennial Park	Bicentennial DRIVE	Landfill	Ongoing maintenance required to manage residual contamination (CLM Act)	-33.84456248	151.0788116
SYDNEY OLYMPIC PARK	Woo-la-ra Landfill	Hill ROAD	Landfill	Ongoing maintenance required to manage residual contamination (CLM Act)	-33.82695807	151.07282
SYDNEY OLYMPIC PARK	Blaxland Common Landfill	Jamieson STREET	Landfill	Ongoing maintenance required to manage residual contamination (CLM Act)	-33.82638382	151.05972
SYDNEY OLYMPIC PARK	Kronos Hill Landfill	Kevin Coombes AVENUE	Landfill	Ongoing maintenance required to manage residual contamination (CLM Act)	-33.84014442	151.0649521
SYDNEY OLYMPIC PARK	Wilson Park (Former oil gas plant site)	Newington ROAD	Gasworks	Ongoing maintenance required to manage residual contamination (CLM Act)	-33.82633586	151.0534322
SYDNEY OLYMPIC PARK	Former Golf Driving Range Landfill	Sarah Durack AVENUE	Landfill	Ongoing maintenance required to manage residual contamination (CLM Act)	-33.85358517	151.0713987
SYDNEY OLYMPIC PARK	Aquatic Centre Carpark Landfill	Shane Gould AVENUE	Landfill	Ongoing maintenance required to manage residual contamination (CLM Act)	-33.85093439	151.0656713
SYLVANIA	Caltex Service Station - Sylvania Heights	414-416 Princes HIGHWAY	Service Station	Contamination currently regulated under CLM Act	-34.02361051	151.0895394
SYLVANIA	Caltex Service Station	61 Port Hacking ROAD	Service Station	Regulation under CLM Act not required	-34.0140089	151.104212
TALBINGO	Old Town Landfill	Bridle STREET	Landfill	Regulation under CLM Act not required	-35.59018237	148.3041771
TALBINGO	T3 Spoil dump and adjoining river sediments	Off Snowy Mountains HIGHWAY	Landfill	Contamination formerly regulated under the CLM Act	-35.6177268	148.2926158
TALBINGO	Former grit blasting site	Old Damsite ROAD	Other Industry	Regulation under CLM Act not required	-35.60894551	148.3030165

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Search Results

No results found.

Enter at least one search criterion.

Search Hints

Search | Reset form

Place name

Street name
links road

Town or suburb
st marys

State
--All--

Country

Advanced search options

List
All Lists

Different lists will provide different status and class options

Local Government Area

Place ID number

Legal status
--All--

Class
--All--

Keyword Search

☑ Description ☑ Statement of Significance ☑ Place history

Latitude/Longitude

N

Latitude 1

Longitude 1 S Longitude 2

W E Latitude 2 E E

S

○ Wholly within region
◉ Wholly or partially within region

Longitude coordinates should be entered as ddd.mm.ss
Latitude coordinates should be entered as dd.mm.ss

Map Ref No

1:100,000 eg 2357
1:250,000 eg SF-50-01

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Search Hints

- Not all fields need to be filled in. The fewer you fill in the more results you will get.
- If you cannot find a place, check spelling and try alternative names. Reduce the number of words that you include and use fewer fields.
- The Local Government field used on its own will provide a comprehensive list of places in an area.

Report Produced: Wed Mar 28 15:46:00 2018

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Office of Environment & Heritage

Home > Topics > Heritage places and items > Search for heritage

Search for NSW heritage

Your search did not return any matching results. Please refine your search and try again.
The State Heritage Inventory is a list of heritage items in New South Wales including Aboriginal Places, State Heritage Register, Interim Heritage Orders, State Agency Heritage Registers and Local Environmental Plans.

The Heritage Division is directly responsible for maintaining **Aboriginal Places** and the **State Heritage Register**. A new **combined map search** is now available. For further information about Aboriginal Places and Sites refer to **AHIMS Web Services**

Whilst the Heritage Division seeks to keep the Inventory up to date, it is reliant on State agencies and local councils to provide their data. Always check with the relevant State agency or local council for the most up-to-date information.

Visit **State Heritage Inventory help** if you are unfamiliar with this search facility.

Basic search criteria

Item name/database ID:	
Street name:	links road
Suburb/town:	st marys
Local Government Area:	Please Choose...
Local Aboriginal Land Council (LALC):	Please Choose...
Heritage listings:	(For Aboriginal Place and State Heritage Register only) Please Choose...
SHR number:	

Additional search criteria

NOTE: For items listed by local councils, there may not be information in the additional search criteria fields.

Owner organisation*:	
Designer/builder:	
Year of construction:	from / to:
Item type:	Please Choose...
Item group:	Please Choose...
Item category:	Please Choose...
Australian historic theme:	Please Choose...
NSW historic theme:	Please Choose...
Significance, description, historical notes:	

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Information complete: ☐

Search

Reset

***View owner organisation names for section 170 heritage and conservation registers**

Search Aboriginal Places & State Heritage Register

The combined map search below is for Aboriginal Places and State Heritage Register items only. It does not include Interim Heritage Orders, State Agency Heritage Registers and Local Environmental Plans.

The location of Aboriginal Places and State Heritage Register items are marked on the map as a single approximation point for general identification and research purposes only.

Location information for some Aboriginal Places (e.g. burial grounds and sacred sites) have been generalised because of their cultural sensitivity. Location information for restricted Aboriginal Places is not shown at all. If an activity or development is proposed that may potentially impact on or harm (i.e., damage, deface or destroy) an Aboriginal Place, then proponents must undertake a search for the exact boundaries of Aboriginal Places through **AHIMS Web Services**.

Downloading of State Heritage Register spatial datasets and associated metadata into a Geographical Information System (GIS) software package is available through **Data NSW**

Listing Type: ◉ All ○ Aboriginal Places ○ State Heritage Register

Local government area: Please Choose...

Item name/Database ID:

SHR number:

Location:

Local Aboriginal Land Council (LALC): Please Choose...

State theme: Please Choose...

Item type: Please Choose...

Item Group: Please Choose...

Item category: Please Choose...

Search

Reset



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Appendix E Field Decontamination and Calibration Documents

Document Set ID: 8477747
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Field Reporting Cover Sheet

PROJECT NAME: Links Road	**PROJECT NO:**
FIELD DATES: 31/01/18	**JBS PM:** Katie Linz
FIELD STAFF: Robert Sim	
WEATHER: fine - cloudy slight possibly Rain	
PROPOSED WORKS: service locating & traffic control.	

SUMMARY OF FIELDWORK:

- service locating

- Note possition matched by service locator.

IMPORTANT OUTCOMES TO NOTE:

COC SENT? —	**DATE SAMPLES SENT:** —
PRIMARY LAB: —	**SECONDARY LAB:** —

POST-FIELDWORK CHECKLIST

- [x] COC checked with PM
- [x] Site map updated and attached
- [x] Field data sheets attached (bore logs, well monitoring sheets)
- [x] Calibration and decontamination sheets attached
- [x] Field notes attached
- [x] Photos downloaded to file
- [x] Electronic bore logs completed and checked

OUTSTANDING ACTIONS:

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Daily Field Report

Date: 31/01/18
Arrival Time 0630
Depart Time 1430
Site Address Links Rd.

Completed by rgs.
Weather cloudy.
Subcontractor(s) service locating

Purpose of Visit

service locating & traffic control.

Notes

(include sketch or attach site map/plan)

- Prestart & toolbox.
- start locating at links Rd central Prospect entrance.
start to remember keep testpits to west edge of road close as possible to fence at corner keep to northern edge of road as other side has high pressure main must remain 3m - 5m away.
- also telstra as its hard to find.
- Relocate to other end. cut fence down and enter to find water service and start locating
- Note homeless man site entry caution leaving vehicals un attended.

Associated Completed Forms

(eg, bore logs, PID/XRF calibration forms)

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Document Set ID: 8477747
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Field Reporting Cover Sheet

PROJECT NAME: S4340 - Links Road	**PROJECT NO:** S4340
FIELD DATES: 01/02/18	**JBS PM:** Klinz
FIELD STAFF: Robert Lenf	
WEATHER: fine	
PROPOSED WORKS: sampl abandoned Road.	
SUMMARY OF FIELDWORK: - start at Chusky street.	
IMPORTANT OUTCOMES TO NOTE: QAQC20180201-QA34 0.0-0.1	
COC SENT? Yes	**DATE SAMPLES SENT:** 02/02/18
PRIMARY LAB: eurofins	**SECONDARY LAB:** enviolab

POST-FIELDWORK CHECKLIST

- ☑ COC checked with PM
- ☑ Site map updated and attached
- ☑ Field data sheets attached (bore logs, well monitoring sheets)
- ☑ Calibration and decontamination sheets attached
- ☑ Field notes attached
- ☑ Photos downloaded to file
- ☑ Electronic bore logs completed and checked

OUTSTANDING ACTIONS:

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Daily Field Report

Date: 01/02/18
Arrival Time 0600
Depart Time 1430
Site Address Links Road.

Completed by RJS
Weather fine.
Subcontractor(s) Ken Col

Purpose of Visit
- Sample abandoned area of Road.

Notes
(include sketch or attach site map/plan)
- locate stockpiles.
sample.
- stockpile on north is SP01 - 2 locations
south is SP02 2 locations
- Ron visited moved snake bite kit to edge of car with extinguisher
- end of day easy nor more work can be done without traffic control.

Associated Completed Forms
(eg, bore logs, PID/XRF calibration forms)

Note
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Field Equipment Calibration and Decontamination

JBS&G

PROJECT NAME: Links Road	PROJECT NO: S4340
FIELD DATES: 01/02/18	FIELD STAFF: R Sharp

CALIBRATION SUMMARY	
EQUIPMENT:	PID
CALIBRATION STANDARD:	Isobutylene 0-100ppm

DATE	TIME	READING (ppm,)	COMMENTS
01/02/18	0640	0	pass
01/02	0645	100	pass

DECONTAMINATION SUMMARY

EQUIPMENT: excavator

1. Was the equipment decontaminated appropriately prior to sampling at each location?	(Y)	N	(NA)
2. Was excess soil removed by scraping, brushing or wiping with disposable towels?	(Y)	N	(NA)
3. Was the equipment contaminated with grease, tar or similar material?	Y	(N)	(NA)
If so, was the equipment steam cleaned or rinsed with pesticide-grade acetone:hexane?	Y	N	
4. Was phosphate-free detergent used to wash the equipment?	Y	N	(NA)
5. Was the equipment rinsed with clean water?	Y	N	(NA)
6. Was the equipment then rinsed with deionised water?	Y	N	(NA)
7. Were all sample containers cleaned and acid or solvent washed prior to sample collection?	(Y)	N	NA

WERE ANY ADDITIONAL DECONTAMINATION MEASURES REQUIRED? PROVIDE DETAILS.

New Nitrial gloves where used for each sample. Sample taken from middle of excavation.

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Field Reporting Cover Sheet

JBS&G

PROJECT NAME: Links Road upgrade.	**PROJECT NO:** 83480
FIELD DATES: 02/02/18	**JBS PM:** K Lintz.
FIELD STAFF: Robert Scrip Sam Heerton.	
WEATHER: Warm.	
PROPOSED WORKS: Sample along Road.	

SUMMARY OF FIELDWORK:

- Sample edge of Road.
- Caution used with grass
- GPS all locations.

IMPORTANT OUTCOMES TO NOTE:

QAQC20180202-01 TP 18 @ 0-0.1
02 TP13 0.0-0.1
03 TP12 0.0-0.1
04 TP11 0.0-0.1

COC SENT? Yes.	**DATE SAMPLES SENT:** 02/02/18
PRIMARY LAB: Eurofins.	**SECONDARY LAB:** Envirolab

POST-FIELDWORK CHECKLIST

- ☐ COC checked with PM
- ☐ Site map updated and attached
- ☐ Field data sheets attached (bore logs, well monitoring sheets)
- ☐ Calibration and decontamination sheets attached
- ☐ Field notes attached
- ☐ Photos downloaded to file
- ☐ Electronic bore logs completed and checked

OUTSTANDING ACTIONS:

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Daily Field Report

Date: 02/02/18
Arrival Time 0610
Depart Time 1900
Site Address Links Rd

Completed by RJS.
Weather fine
Subcontractor(s) Adams Traffic for Ken Coles.

Purpose of Visit

sample along links Road.

Notes

(include sketch or attach site map/plan)

- Start with inductions - question raised about why photo of licence taken. told for purpose of safety and if you drive onsite its required.
- sample from concrete barrier.
- Note there are a few stockpiles fly tipped.
- stained area sampled looks like from an old fire.
- location 14 - lots of ACM around Pink.
- stay back to gps all stockpiles found and materials suspected as ACM.

- Also noted more stockpiles could be found when excavation starts.

Associated Completed Forms

(eg, bore logs, PID/XRF calibration forms)

Note
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Field Equipment Calibration and Decontamination

JBS&G

PROJECT NAME:	02/02/18	PROJECT NO:	S4340
FIELD DATES:	Links Road St Marys	FIELD STAFF:	RSL

CALIBRATION SUMMARY	
EQUIPMENT:	PID
CALIBRATION STANDARD:	isobutylene

DATE	TIME	READING (ppm_v)	COMMENTS
02/02	0630	0	pass
02/02	0635	100	pass

DECONTAMINATION SUMMARY

EQUIPMENT: excavator

1. Was the equipment decontaminated appropriately prior to sampling at each location?	(Y)	N	NA
2. Was excess soil removed by scraping, brushing or wiping with disposable towels?	Y	N	(NA)
3. Was the equipment contaminated with grease, tar or similar material?	Y	N	(NA)
If so, was the equipment steam cleaned or rinsed with pesticide-grade acetone:hexane?	Y	N	
4. Was phosphate-free detergent used to wash the equipment?	Y	N	(NA)
5. Was the equipment rinsed with clean water?	Y	N	(NA)
6. Was the equipment then rinsed with deionised water?	Y	N	(NA)
7. Were all sample containers cleaned and acid or solvent washed prior to sample collection?	(Y)	N	NA

WERE ANY ADDITIONAL DECONTAMINATION MEASURES REQUIRED? PROVIDE DETAILS.

new nitrial gloves with each sample.
sample collected from middle of excavation.

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TP01

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 5/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 1
Bore Diameter (mm):

Eastings (GDA 94): 292905.925
Northings (GDA 94): 6264615.378
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, dark brown/grey/black, heterogeneous, dry, non-plastic, soft, with inclusions of rootlets, plastic, and igneous gravels	TP01 0.0-0.1 PID = 0 ppm	No odour, ACM, or staining
		0.10		Fill	Fill - Silty CLAY, grey/brown, heterogeneous, damp, high plasticity, soft, with inclusions of plastic, steel fragments, and gravels	TP01 0.2-0.3 PID = 0 ppm	No odour, ACM, or staining
		0.40		CH-MH	Silty CLAY, grey with red mottling, homogeneous, damp, high plasticity, soft	TP01 0.5-0.6 PID = 0 ppm	No odour, ACM, or staining
	1	1.00			Borehole TP01 terminated at 1m		EOH as per scope
	2						
	3						
	4						
	5						
	6						

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TP02

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 5/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.8
Bore Diameter (mm):

Eastings (GDA 94): 292882.4185
Northings (GDA 94): 6264596.294
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, dark brown/grey/black, heterogeneous, dry, non-plastic, soft, with inclusions of rootlets, asphalt, roadbase, and plastic	TP02 0.0-0.1 PID = 0 ppm	No odour, ACM, or staining
		0.10		Fill	Fill - Gravelly Silty CLAY, brown, heterogeneous, dry, low plasticity, soft to firm, with inclusions of rootlets, angular to sub-angular gravels, and traces of ironstone	TP02 0.2-0.3 PID = 0.1 ppm	No odour, ACM, or staining
		0.40		CH-MH	Silty CLAY, grey with red/orange mottling, homogeneous, damp, medium plasticity, soft	TP02 0.5-0.6 PID = 0.5 ppm	No odour, ACM, or staining
		0.80			Borehole TP02 terminated at 0.8m		EOH as per scope

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TP03

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 5/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 1
Bore Diameter (mm):

Eastings (GDA 94): 292851.3304
Northings (GDA 94): 6264561.789
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				SM	Silty SAND, heterogeneous, dry, poorly graded, with inclusions of plant bulbs and rootlets	TP03 0.0-0.1 PID = 0 ppm	No odour, ACM, or staining
		0.10		CL-ML	Silty CLAY, grey/brown with red mottling, homogeneous, dry, low plasticity, firm	TP03 0.2-0.3 PID = 0.6 ppm	No odour, ACM, or staining
		0.40		CL-ML	Silty CLAY, grey with red mottling, homogeneous, dry, low plasticity, soft to firm, with inclusions of ironstone	TP03 0.5-0.6 PID = 0.8 ppm	No odour, ACM, or staining
	1	1.00			Borehole TP03 terminated at 1m		EOH as per scope
	2						
	3						
	4						
	5						
	6						

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TP04

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 5/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.8
Bore Diameter (mm):

Eastings (GDA 94): 292820.6556
Northings (GDA 94): 6264534.17
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, brown/grey, heterogeneous, dry, non-plastic, soft, with inclusions of metal, roadbase, and glass	TP04 0.0-0.1 PID = 0.8 ppm	No odour, ACM, or staining
		0.10		CL-ML	Silty CLAY, brown/grey, heterogeneous, dry, non-plastic, soft, with inclusions of rootlets	TP04 0.2-0.3 PID = 0.7 ppm	No odour, ACM, or staining
		0.40		CL-ML	Silty CLAY, grey/brown with orange/red mottling, homogeneous, dry, non-plastic to low plasticity, stiff	TP04 0.5-0.6 PID = 0.1 ppm	No odour, ACM, or staining
		0.80			Borehole TP04 terminated at 0.8m		EOH as per scope

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TP05

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 5/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.8
Bore Diameter (mm):

Eastings (GDA 94): 292791.0697
Northings (GDA 94): 6264507.239
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, brown, heterogeneous, dry, non-plastic, soft to firm, with inclusions of glass, plastic, and rootlets	TP05 0.0-0.1 PID = 0.4 ppm	No odour, ACM, or staining
		0.10		Fill	Fill - Silty CLAY, brown, heterogeneous, dry, non-plastic, soft, with inclusions of rootlets, and traces of rounded gravels	TP05 0.2-0.3 PID = 0.9 ppm	No odour, ACM, or staining
		0.40		CL-ML	Silty CLAY, grey/brown with orange/red mottling, homogeneous, dry, non-plastic, soft to firm	TP05 0.5-0.6 PID = 1 ppm	No odour, ACM, or staining
		0.80			Borehole TP05 terminated at 0.8m		EOH as per scope

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TP06

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 5/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.8
Bore Diameter (mm):

Eastings (GDA 94): 292765.9433
Northings (GDA 94): 6264482.641
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				CL-ML	Silty CLAY, brown, heterogeneous, dry, non-plastic, soft, with inclusions of rootlets	TP06 0.0-0.1 PID = 0 ppm	No odour, ACM, or staining
		0.10		CL-ML	Silty CLAY, brown, dry, non-plastic, soft, with inclusions of rootlets	TP06 0.2-0.3 PID = 0.2 ppm	No odour, ACM, or staining
		0.30		CL-ML	Silty CLAY, brown with orange/red mottling, dry, low to medium plasticity, firm, with inclusions of ironstone	TP06 0.5-0.6 PID = 0 ppm	No odour, ACM, or staining
		0.80			Borehole TP06 terminated at 0.8m		EOH as per scope

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TP07

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 5/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.8
Bore Diameter (mm):

Eastings (GDA 94): 292739.9008
Northings (GDA 94): 6264457.829
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, brown, heterogeneous, non-plastic, soft, with inclusions of glass, roadbase, asphalt, and rootlets	TP07 0.0-0.1 PID = 0.6 ppm	No odour, ACM, or staining
		0.10		Fill	Fill - Silty CLAY, brown, heterogeneous, non-plastic, soft, with inclusions of ash	TP07 0.2-0.3 PID = 2 ppm	No odour, ACM, or staining
		0.40		CL-ML	Silty CLAY, brown with red mottling, homogeneous, dry, non-plastic, stiff	TP07 0.5-0.6 PID = 1.6 ppm	No odour, ACM, or staining
		0.80			Borehole TP07 terminated at 0.8m		EOH as per scope

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TP08

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 5/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.8
Bore Diameter (mm):

Eastings (GDA 94): 292712.1909
Northings (GDA 94): 6264431.14
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, brown, heterogeneous, dry, non-plastic, soft, with inclusions of rootlets, roadbase, blue metals, asphalt, and plastic	TP08 0.0-0.1 PID = 1.8 ppm	No odour, ACM, or staining
		0.10		Fill	Fill - Silty CLAY, brown, heterogeneous, dry, non-plastic, soft, with trace inclusions of asphalt, roadbase, and slag	TP08 0.2-0.3 PID = 1 ppm	No odour, ACM, or staining
		0.30		CH-MH	Silty CLAY, brown with red mottling, homogeneous, dry, medium plasticity, firm	TP08 0.5-0.6 PID = 1.1 ppm	No odour, ACM, or staining
		0.80			Borehole TP08 terminated at 0.8m		EOH as per scope

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TP09

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 5/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.6
Bore Diameter (mm):

Eastings (GDA 94): 292680.9895
Northings (GDA 94): 6264403.033
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, heterogeneous, dry, medium plasticity, firm, with trace inclusions of bricks and glass	TP09 0.0-0.1 PID = 1.4 ppm	No odour, ACM, or staining
						TP09 0.2-0.3 PID = 1.4 ppm	No odour, ACM, or staining
		0.30		CL	CLAY, grey with orange mottling, dry, non-plastic, firm		
		0.50				TP09 0.5-0.6 PID = 1.3 ppm	No odour, ACM, or staining
					Borehole TP09 terminated at 0.6m		EOH as per scope

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TP10

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 5/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.5
Bore Diameter (mm):

Eastings (GDA 94): 292673.628
Northings (GDA 94): 6264362.603
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, dry, non-plastic, firm, with trace inclusions of glass	TP10 0.0-0.1 PID = 0 ppm	No odour, ACM, or staining
		0.15		CL	CLAY, brown with red mottling, dry, non-plastic, firm	TP10 0.2-0.3 PID = 0.4 ppm	No odour, ACM, or staining
		0.50			Borehole TP10 terminated at 0.5m		EOH as per scope

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TP11

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 5/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.5
Bore Diameter (mm):

Eastings (GDA 94): 292691.2678
Northings (GDA 94): 6264347.489
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				CL	CLAY, light brown with red mottling, homogeneous, dry, non-plastic, firm	TP11 0.0-0.1 PID = 0.8 ppm	No odour, ACM, or staining
		0.15		CL	CLAY, light brown with red mottling, homogeneous, damp, non-plastic, firm	TP11 0.2-0.3 PID = 0.1 ppm	No odour, ACM, or staining
		0.50			Borehole TP11 terminated at 0.5m		EOH as per scope

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TP12

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 5/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.7
Bore Diameter (mm):

Eastings (GDA 94): 292719.5865
Northings (GDA 94): 6264320.212
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, grey/brown, heterogeneous, dry, non-plastic, soft, with trace inclusions of glass and rootlets	TP12 0.0-0.1 PID = 0.1 ppm	No odour or staining. ACM on surface 15m from TP.
		0.20		CL	CLAY, light brown, homogeneous, dry, non-plastic, firm	TP12 0.2-0.3 PID = 0 ppm	No odour, ACM, or staining
		0.40		CL	CLAY, dark red, homogeneous, dry, non-plastic, firm	TP12 0.5-0.6 PID = 0 ppm	No odour, ACM, or staining
		0.70			Borehole TP12 terminated at 0.7m		EOH as per scope

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TP13

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.5
Bore Diameter (mm):

Eastings (GDA 94): 292743.3093
Northings (GDA 94): 6264290.919
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, dark brown, heterogeneous, dry, non-plastic, soft, with inclusions of rootlets	TP13 0.0-0.1 PID = 1.4 ppm	No odour, ACM, or staining
		0.20		CL-ML	Silty CLAY, orange/brown, homogeneous, dry, low plasticity, soft	TP13 0.2-0.3 PID = 0.8 ppm	No odour, ACM, or staining
		0.50			Borehole TP13 terminated at 0.5m		EOH as per scope

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TP14

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.8
Bore Diameter (mm):

Eastings (GDA 94): 292762.9118
Northings (GDA 94): 6264251.677
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, brown/black, heterogeneous, dry, low plasticity, soft, with inclusions of roadbase, asphalt, brick, ash, ACM fragments	TP14 0.0-0.1 PID = 0.8 ppm	No odour or staining. ACM fragments observed.
		0.20		Fill	Fill - Silty CLAY, brown, heterogeneous, dry, low plasticity, soft, with inclusions of gravel, and ACM fragments	TP14 0.2-0.3 PID = 0.9 ppm	No odour or staining. 1 ACM fragment observed.
		0.50		CL-ML	Silty CLAY, grey/orange with brown mottling, homogeneous, dry, low plasticity, soft	TP14 0.5-0.6 PID = 0.3 ppm	No odour, ACM, or staining
		0.80			Borehole TP14 terminated at 0.8m		EOH as per scope

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TP15

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.5
Bore Diameter (mm):

Eastings (GDA 94): 292779.2599
Northings (GDA 94): 6264217.942
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Gravelly Silty CLAY, dark grey/brown, heterogeneous, dry, low plasticity, soft, with inclusions of rootlets and gravel	TP15 0.0-0.1 PID = 0.2 ppm	No odour, ACM, or staining
		0.10		CL-ML	Silty CLAY, grey/orange, homogeneous, dry, low plasticity, soft, more orange with increasing depth	TP15 0.2-0.3 PID = 0.3 ppm	No odour, ACM, or staining
		0.50			Borehole TP15 terminated at 0.5m		EOH as per scope

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TP16

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.5
Bore Diameter (mm):

Eastings (GDA 94): 292788.9511
Northings (GDA 94): 6264181.49
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Gravelly Silty CLAY, brown, dry, soft, with inclusions of rootlets, asphalt, and shale	TP16 0.0-0.1 PID = 0.9 ppm	No odour, ACM, or staining
		0.10		Fill	Fill - Gravelly Silty CLAY, orange/brown, homogeneous, dry, low plasticity, soft, with trace inclusions of shale	TP16 0.2-0.3 PID = 0.8 ppm	No odour, ACM, or staining
		0.50			Borehole TP16 terminated at 0.5m		EOH as per scope

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TP17

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.5
Bore Diameter (mm):

Eastings (GDA 94): 292792.4862
Northings (GDA 94): 6264148.298
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Gravelly Silty CLAY, brown, with inclusions of shale and asphalt	TP17 0.0-0.1 PID = 0.7 ppm	No odour, ACM, or staining
		0.10		Fill	Fill - Silty CLAY, grey/white with orange mottling, homogeneous, dry, low plasticity, with trace inclusions of ironstone	TP17 0.2-0.3 PID = 0.4 ppm	No odour, ACM, or staining
		0.50			Borehole TP17 terminated at 0.5m		EOH as per scope

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TP18

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.5
Bore Diameter (mm):

Eastings (GDA 94): 292796.7437
Northings (GDA 94): 6264115.62
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, brown, heterogeneous, damp, low plasticity, soft, with inclusions of metal, plastic, and asphalt	TP18 0.0-0.1 PID = 0.6 ppm	No odour, ACM, or staining
		0.15		CL-ML	Silty CLAY, orange/brown, homogeneous, dry, non-plastic, soft, with inclusions of rootlets	TP18 0.2-0.3 PID = 0.1 ppm	No odour, ACM, or staining
		0.50			Borehole TP18 terminated at 0.5m		EOH as per scope

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TP19

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.5
Bore Diameter (mm):

Eastings (GDA 94): 292801.09
Northings (GDA 94): 6264084.765
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, brown, non-plastic, soft, with trace inclusions of asphalt, ash, and rootlets	TP19 0.0-0.1 PID = 1.4 ppm	No odour, ACM, or staining
		0.10		CL-ML	Silty CLAY, grey/light grey with orange mottling, homogeneous, dry, non-plastic, very soft	TP19 0.2-0.3 PID = 1.1 ppm	No odour, ACM, or staining
		0.50			Borehole TP19 terminated at 0.5m		EOH as per scope

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TP20

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.5
Bore Diameter (mm):

Eastings (GDA 94): 292804.5728
Northings (GDA 94): 6264049.386
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, heterogeneous, dry, non-plastic, soft, with inclusions of rootlets, angular gravels, and trace asphalt	TP20 0.0-0.1 PID = 1 ppm	No odour, ACM, or staining
		0.10		CL-ML	Silty CLAY, grey, homogeneous, dry, non-plastic, soft, with traces of ironstone	TP20 0.2-0.3 PID = 1.1 ppm	No odour, ACM, or staining
		0.50			Borehole TP20 terminated at 0.5m		EOH as per scope

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TP21

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.5
Bore Diameter (mm):

Eastings (GDA 94): 292808.4716
Northings (GDA 94): 6264015.082
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, grey/brown, heterogeneous, dry, non-plastic, soft, with inclusions of rootlets	TP21 0.0-0.1 PID = 1.6 ppm	No odour, ACM, or staining
		0.10		CL-ML	Silty CLAY, grey with orange mottling, homogeneous, dry, non-plastic, soft, with inclusions of rootlets	TP21 0.2-0.3 PID = 1.6 ppm	No odour, ACM, or staining
		0.50			Borehole TP21 terminated at 0.5m		EOH as per scope

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TP22

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.5
Bore Diameter (mm):

Eastings (GDA 94): 292817.2118
Northings (GDA 94): 6263982.219
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - CLAY, grey/brown, heterogeneous, dry, medium density, with trace inclusions of glass and blue metal	TP22 0.0-0.1 PID = 0.3 ppm	No odour, ACM, or staining
		0.15		CL	CLAY, orange, homogeneous, dry, fine to medium gravel, rounded, medium density, with inclusions of ironstone	TP22 0.2-0.3 PID = 0.2 ppm	No odour, ACM, or staining
		0.50			Borehole TP22 terminated at 0.5m		EOH as per scope

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TP23

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.4
Bore Diameter (mm):

Eastings (GDA 94): 292828.1889
Northings (GDA 94): 6263954.188
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, grey/brown, dry, soft, with inclusions of rootlets and traces of glass	TP23 0.0-0.1 PID = 0.1 ppm	No odour, ACM, or staining
		0.10		CL-ML	Silty CLAY, orange/brown, homogeneous, dry, non-plastic, soft, with inclusions of rootlets	TP23 0.2-0.3 PID = 0.6 ppm	No odour, ACM, or staining
		0.40			Borehole TP23 terminated at 0.4m		EOH as per scope

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TP24

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.8
Bore Diameter (mm):

Eastings (GDA 94): 292840.6669
Northings (GDA 94): 6263925.692
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, grey/brown, heterogeneous, dry, soft, with inclusions of rootlets, traces of ironstone, shale, and glass	TP24 0.0-0.1 PID = 0.4 ppm	No odour, ACM, or staining
		0.10		CL-ML	Silty CLAY, orange/brown, homogeneous, dry, non-plastic, soft, with inclusions of rootlets	TP24 0.2-0.3 PID = 0 ppm	No odour, ACM, or staining
		0.30		CL-ML	Silty CLAY, orange/red, homogeneous, dry, non-plastic, very stiff, with inclusions of rootlets	TP24 0.4-0.5 PID = 1 ppm	No odour, ACM, or staining
		0.80			Borehole TP24 terminated at 0.8m		EOH as per scope

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TP25

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.5
Bore Diameter (mm):

Eastings (GDA 94): 292857.5207
Northings (GDA 94): 6263898.512
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, dark grey/brown, heterogeneous, dry, soft, with inclusions of plastic, rubbish, and rootlets	TP25 0.0-0.1 PID = 0.9 ppm	No odour, ACM, or staining
		0.15		CL-ML	Silty CLAY, grey with orange mottling, homogeneous, non-plastic, soft to firm, with trace inclusions of ironstone	TP25 0.2-0.3 PID = 2 ppm	No odour, ACM, or staining
		0.50			Borehole TP25 terminated at 0.5m		EOH as per scope

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TP26

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 1.8
Bore Diameter (mm):

Eastings (GDA 94): 292868.7723
Northings (GDA 94): 6263863.232
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Gravelly Silty CLAY, brown, heterogeneous, damp, low plasticity, soft, with inclusions of asphalt	TP26 0.0-0.1 PID = 0.2 ppm	No odour, ACM, or staining
		0.10		Fill	Gravelly Silty CLAY, orange/brown, heterogeneous, damp, low plasticity, soft, with trace inclusions of asphalt	TP26 0.2-0.3 PID = 0.2 ppm	No odour, ACM, or staining
		0.50		CL-ML	Silty CLAY, dark brown, homogeneous, damp, low to medium plasticity, soft	TP26 0.5-0.6 PID = 0.1 ppm	No odour, ACM, or staining
		0.70		CL-ML	Silty CLAY, prange, homogeneous, damp, low to medium plasticity, firm to stiff		
	1					TP26 0.9-1.0 PID = 0 ppm	No odour, ACM, or staining
						TP26 1.4-1.5 PID = 0 ppm	No odour, ACM, or staining
		1.80			Borehole TP26 terminated at 1.8m		EOH as per scope
	2						
	3						
	4						
	5						
	6						

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TP27

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 2/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 1.1
Bore Diameter (mm):

Eastings (GDA 94): 292896.2408
Northings (GDA 94): 6263847.249
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Silty CLAY, brown, heterogeneous, dry, non-plastic, soft, with trace inclusions of plastic, aggregate, ash, and rootlets	TP27 0.0-0.1 PID = 1.1 ppm	No odour, ACM, or staining
		0.10		CL-ML	Silty CLAY, orange/brown, homogeneous, dry, non-plastic, with inclusions of ironstone and rootlets	TP27 0.2-0.3 PID = 1 ppm	No odour, ACM, or staining
		0.40		CL-ML	Silty CLAY, brown, heterogeneous, dry, low plasticity, soft, with inclusions of rootlets and traces of glass	TP27 0.5-0.6 PID = 0.6 ppm	No odour, ACM, or staining
	1	0.80		CL-ML	Silty CLAY, grey with orange mottling, homogeneous, dry, non-plastic, soft, with inclusions of rootlets and ironstone	TP27 0.9-1.0 PID = 0.3 ppm	No odour, ACM, or staining
		1.10			Borehole TP27 terminated at 1.1m		EOH as per scope
	2						
	3						
	4						
	5						
	6						

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TP28

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.7
Bore Diameter (mm):

Eastings (GDA 94): 292929.3317
Northings (GDA 94): 6263836.73
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - ROAD BASE - Track Ballast, grey, homogeneous, coarse cobbles, loose	TP28 0.0-0.1 PID = 0.3 ppm	No odour, ACM, or staining
						TP28 0.2-0.3 PID = 0.4 ppm	No odour, ACM, or staining
		0.50		CH	CLAY, homogeneous, medium plasticity, firm, with trace inclusions of weathered shale	TP28 0.5-0.6 PID = 0 ppm	No odour, ACM, or staining
		0.70			Borehole TP28 terminated at 0.7m		EOH as per scope

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TP29

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.9
Bore Diameter (mm):

Eastings (GDA 94): 292958.6598
Northings (GDA 94): 6263818.565
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - ROAD BASE - Track Ballast, grey, homogeneous, coarse cobbles, loose	TP29 0.0-0.1 PID = 0 ppm	No odour, ACM, or staining
						TP29 0.2-0.3 PID = 0.2 ppm	No odour, ACM, or staining
		0.50		CH	CLAY, brown with red mottling, dry, soft	TP29 0.5-0.6 PID = 0 ppm	No odour, ACM, or staining
	1	0.90			Borehole TP29 terminated at 0.9m		EOH as per scope
	2						
	3						
	4						
	5						
	6						

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TP30

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.7
Bore Diameter (mm):

Eastings (GDA 94): 292980.7135
Northings (GDA 94): 6263803.995
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - ROAD BASE - Track Ballast, grey, heterogeneous, dry, fine cobbles	TP30 0.0-0.1 PID = 0 ppm	No odour, ACM, or staining
						TP30 0.2-0.3 PID = 0.8 ppm	No odour, ACM, or staining
		0.40		CH	CLAY, brown with red mottling, heterogeneous	TP30 0.5-0.6 PID = 0.9 ppm	No odour, ACM, or staining
		0.70			Borehole TP30 terminated at 0.7m		EOH as per scope
	1						
	2						
	3						
	4						
	5						
	6						

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TP31

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.7
Bore Diameter (mm):

Eastings (GDA 94): 293006.6673
Northings (GDA 94): 6263791.979
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - ROAD BASE - Track Ballast, grey, homogeneous, coarse cobbles, loose	TP31 0.0-0.1 PID = 0.7 ppm	No odour, ACM, or staining
		0.20		Fill	Fill - FLY ASH - Track Ballast, grey, heterogeneous, dry, fine to coarse cobbles	TP31 0.2-0.3 PID = 0 ppm	No odour, ACM, or staining
		0.40		CH	CLAY, brown with red mottling, damp, medium plasticity, firm	TP31 0.5-0.6 PID = 0 ppm	No odour, ACM, or staining
		0.70			Borehole TP31 terminated at 0.7m		EOH as per scope

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TP32

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.6
Bore Diameter (mm):

Eastings (GDA 94): 293036.6017
Northings (GDA 94): 6263781.509
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - ROAD BASE - Track Ballast, grey, damp, coarse cobbles	TP32 0.0-0.1 PID = 0 ppm	No odour, ACM, or staining
		0.20		Fill	Fill - FLY ASH - Track Ballast, homogeneous, coarse cobbles	TP32 0.2-0.3 PID = 0 ppm	No odour, ACM, or staining
		0.30		CH	CLAY, mottled grey with inclusions of weathered shale	TP32 0.5-0.6 PID = 0 ppm	No odour, ACM, or staining
		0.60			Borehole TP32 terminated at 0.6m		EOH as per scope

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TP33

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.4
Bore Diameter (mm):

Eastings (GDA 94): 293055.8275
Northings (GDA 94): 6263746.883
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - CLAY, brown, heterogeneous, firm, with inclusions of coarse gravels	TP33 0.0-0.1 PID = 1.1 ppm	No odour, ACM, or staining
		0.20		SHALE	WEATHERED SHALE, grey with orange mottling, fine to coarse, angular, dense	TP33 0.2-0.3 PID = 1.4 ppm	No odour, ACM, or staining
		0.40			Borehole TP33 terminated at 0.4m		EOH as per scope

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TP34

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.4
Bore Diameter (mm):

Eastings (GDA 94): 293075.6958
Northings (GDA 94): 6263738.291
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - CLAY, heterogeneous, dry, with trace inclusions of glass and grass	TP34 0.0-0.1 PID = 1.5 ppm	No odour, ACM, or staining
		0.20		SHALE	WEATHERED SHALE, grey with orange mottling, medium to coarse gravels, dense	TP34 0.2-0.3 PID = 1.2 ppm	No odour, ACM, or staining
		0.40			Borehole TP34 terminated at 0.4m		EOH as per scope

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TP35

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.7
Bore Diameter (mm):

Eastings (GDA 94): 293097.136
Northings (GDA 94): 6263735.492
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - CLAY, heterogeneous, damp, soft, with trace inclusions of fine loose gravels and glass	TP35 0.0-0.1 PID = 1.2 ppm	No odour, ACM, or staining
						TP35 0.2-0.3 PID = 1 ppm	No odour, ACM, or staining
		0.40		SHALE	WEATHERED SHALE, grey with orange mottling, medium to fine gravels, angular, loose to dense	TP35 0.5-0.6 PID = 1.3 ppm	No odour, ACM, or staining
		0.70			Borehole TP35 terminated at 0.7m		EOH as per scope

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TP36

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.7
Bore Diameter (mm):

Eastings (GDA 94): 293124.9048
Northings (GDA 94): 6263717.153
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - GRAVEL, brown, coarse	TP36 0.0-0.1 PID = 0 ppm	No odour, ACM, or staining
		0.10		Fill	Fill - GRAVEL, with inclusions of crushed conrete	TP36 0.2-0.3 PID = 0.2 ppm	No odour, ACM, or staining
		0.40		CL-GC	Gravelly CLAY, grey mottling, coarse	TP36 0.5-0.6 PID = 0.4 ppm	No odour, ACM, or staining
		0.70			Borehole TP36 terminated at 0.7m		EOH as per scope

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TP37

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 1
Bore Diameter (mm):

Eastings (GDA 94): 293153.6279
Northings (GDA 94): 6263698.96
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - CLAY, dry, medium plasticity, with inclusions of concrete and brick	TP37 0.0-0.1 PID = 0.1 ppm	No odour, ACM, or staining
						TP37 0.2-0.3 PID = 0.1 ppm	No odour, ACM, or staining
		0.30		Fill	Fill - ASPHALT		
						TP37 0.5-0.6 PID = 0 ppm	No odour, ACM, or staining
		0.60		Fill	Fill - ROAD BASE, inclusions of rounded, loose gravels	TP37 0.7-0.8 PID = 0.1 ppm	No odour, ACM, or staining
		0.80		CL	CLAY, grey with red mottling, damp		
	1					TP37 0.9-1.0 PID = 0 ppm	No odour, ACM, or staining
		1.00			Borehole TP37 terminated at 1m		EOH as per scope

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TP38

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 1
Bore Diameter (mm):

Eastings (GDA 94): 293169.5399
Northings (GDA 94): 6263682.151
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - CLAY, inclusions of shells and glass	TP38 0.0-0.1 PID = 0 ppm	No odour, ACM, or staining
						TP38 0.2-0.3 PID = 2 ppm	No odour, ACM, or staining
		0.30		Fill	Fill - ASPHALT		
		0.40		Fill	Fill - ROAD BASE, brown, with inclusions of rounded, fine gravels	TP38 0.5-0.6 PID = 1.6 ppm	No odour, ACM, or staining
		0.80		CL	CLAY, brown with red mottling, firm		
	1					TP38 0.9-1.0 PID = 1.9 ppm	No odour, ACM, or staining
		1.00			Borehole TP38 terminated at 1m		EOH as per scope

BOREHOLE JBSG BOREHOLE - 2017.GPJ GINT STD AUSTRALIA.GDT 21/3/18

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TP39

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.4
Bore Diameter (mm):

Eastings (GDA 94): 293194.3072
Northings (GDA 94): 6263663.866
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Gravelly CLAY, fine, loose gravels, with inclusions of brick and asphalt	TP39 0.0-0.1 PID = 1.1 ppm	No odour, ACM, or staining
		0.10		CH	CLAY, grey with red mottling, medium plasticity, firm, with inclusions of rootlets	TP39 0.2-0.3 PID = 0.7 ppm	No odour, ACM, or staining
		0.40			Borehole TP39 terminated at 0.4m		EOH as per scope

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TP40

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 0.4
Bore Diameter (mm):

Eastings (GDA 94): 293214.6848
Northings (GDA 94): 6263633.96
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Fill - Gravelly CLAY, heterogeneous, fine to medium gravels, loose, with inclusions of road base and asphalt	TP40 0.0-0.1 PID = 0.6 ppm	No odour, ACM, or staining
		0.20		CH	CLAY, grey with red mottling, medium plasticity, firm, with inclusions of rootlets	TP40 0.2-0.3 PID = 0 ppm	No odour, ACM, or staining
		0.40			Borehole TP40 terminated at 0.4m		EOH as per scope

BOREHOLE JBSG BOREHOLE - 2017.GPJ GINT STD AUSTRALIA.GDT 21/3/18

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SP01_TP01

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 1.2
Bore Diameter (mm):

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Reworked Natural - CLAY, light brown, with inclusions of rubbish, brick, and concrete		
		0.10		Fill	Reworked Natural - CLAY, red, homogeneous, soft, with inclusions of loose, large rocks		
		0.50		CL	Reworked Natural - CLAY, red		
	1	0.90		CL	Reworked Natural - CLAY, red	SP01_TP01 0.8-0.9 PID = 0.2 ppm	No odour, ACM, or staining
		1.20			Borehole SP01_TP01 terminated at 1.2m		EOH @ Base of SP
	2						
	3						
	4						
	5						
	6						

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SP01_TP02

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 1.5
Bore Diameter (mm):

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit	1			Fill	Reworked Natural - WEATHERED/CLAY SHALE, red/brown/grey, homogeneous, dry, fine to course, angular	SP01_TP02 0.7-0.8 PID = 0.3 ppm	No odour, ACM, or staining
	2	1.50			Borehole SP01_TP02 terminated at 1.5m		EOH @ Base of SP
	3						
	4						
	5						
	6						

BOREHOLE JBSG BOREHOLE - 2017.GPJ GINT STD AUSTRALIA.GDT 21/3/18

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SP02_TP01

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 2.2
Bore Diameter (mm):

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit	1			Fill	Reworked Natural - WEATHERED/CLAY SHALE, red/brown/grey, homogeneous	SP02_TP01 0.9-1.0 PID = 0.7 ppm	No odour, ACM, or staining
	2						EOH @ Base of SP
		2.20			Borehole SP02_TP01 terminated at 2.2m		
	3						
	4						
	5						
	6						

BOREHOLE JBSG BOREHOLE - 2017.GPJ GINT STD AUSTRALIA.GDT 21/3/18

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SP02_TP02

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 5.8
Bore Diameter (mm):

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit	1			Fill	Reworked Natural - CLAY, medium plasticity, soft, with inclusions of fine, loose gravels		
	2						
	3					SP02_TP02 3.4-3.5 PID = 0.4 ppm	No odour, ACM, or staining
	4						
	5						
		5.80			Borehole SP02_TP02 terminated at 5.8m		EOH @ Base of SP
	6						

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SP02_TP03

Project Number: 54340
Client: Maryland Development Company Pty Ltd
Project Name: Links Road PSI
Site Address: Links Road, St Marys

Date: 1/02/2018
Logged By: R.Sharp / S.Heaton
Contractor: Ken Coles
Total Hole Depth (mbgs): 6
Bore Diameter (mm):

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#: N/A
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Test Pit				Fill	Reworked Natural - WEATHERED/CLAY SHALE, grey, heterogeneous, dry, fine, loose	SP02_TP03 0.0-0.1 PID = 0.1 ppm	No odour, ACM, or staining
		0.10		Fill	Reworked Natural - CLAY, yellow, dry, medium plasticity		
	1					SP02_TP03 0.9-1.0 PID = 0.4 ppm	No odour, ACM, or staining
	2						
	3						
	4						
		4.00		Fill	Reworked Natural - CLAY, red/brown, with trace inclusions of asphalt		
						SP02_TP03 4.5-4.6 PID = 0 ppm	No odour, ACM, or staining
	5						
	6						
		6.00			Borehole SP02_TP03 terminated at 6m		EOH @ Base of SP

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Appendix F QA/QC Checker

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ESDAT QA Checker
Project:54340
Filter: ALL

Overview Summary
- Count of Samples
- Summary By Compound
- Count of Results

Holding Times
- Holding Time Errors (937)

Blanks
- Field Blanks
- Detects in Lab Blanks (0)
- SDG's without Storage Blanks (6)
- SDG's without Method Blanks (0)

Duplicates
- Field and Interlab Duplicates
- Lab Duplicates with high RPDs (2)
- Duplicate Samples with incorrect or missing Parent Samples (0)
- Samples at the same Location/Depth/Time not specified as duplicates (0)

Surrogates
- Surrogate Variation > 30% or outside lab LCL or UCL (13)

Lab Control Samples
- SDG's without a Laboratory Control Sample (0)
- Laboratory Control Samples, Error > 30% (0)

Certified and Standard Reference Materials
- Certified Reference Materials - Error > 30% (0)

Matrix Spikes
- SDG's without a Matrix Spike (0)
- Trip Spikes with invalid Control Sample (0)
- Less than 1 matrix spike in 20 samples, or less than 1 matrix duplicate in 20 samples (2)
- Matrix Spike Recoveries less than 70% or greater than 130% or outside lab LCL or UCL (3)
- Trip Spike Recoveries (70% - 130% is acceptable) (0)

Inorganic
- Na + CL > TDS (0)
- BOD > COD (0)
- BOD > COD (0)

Other
- Unit Conversion Problems (2)
- OriginalChemNames Requiring Validation (2)
- Samples with no Results (0)
- Samples associated with Wells which are not specified in the Well Table (26)
- Aborted Analysis (0)

Contents

Count of Samples

Matrix Type	SOIL	WATER
First Sample Date	1/02/2018	
Last Sample Date	5/02/2018	
Sampling Period (days)	5	
Number of Samples Submitted	68	0
Number of Non QA Samples Submitted	63	0
Number of Field Blanks	0	0
Number of Trip Blanks	0	0
Number of Rinsates	0	0
Number of Field Duplicates	3	0
Number of Trip Spikes	0	1
Number of Lab Duplicates	18	0
Number of LCSs	26	1
Number of CRMs	0	0
Number of Method Blanks	22	1
Number of Storage Blanks	0	1
Number of Matrix Spikes	23	0
Number of Matrix Spike Dupes	0	0

Filter: ALL

Matrix_Type	Filter	Method_Type	Chemistries	Range	Num Results: Num QA + Compounds	Holding Times (days): Max Allty Group	Results to Receipt to Analysis	Acceptable	Lab Control Samples: Recovery %	Num Reported	Acceptable	Method and Blanks: Range	Num Reported	Acceptable	Laboratory Duplicates: Max RPD > LOR x 4 ?	Num Reported	Acceptable	Surrogates: Recovery %	Num Reported	Acceptable	Matrix Trip and Compound Spikes: Recovery %	Num Reported	Acceptable	Field Rinsate and Trip Blanks: Range	Num Reported	Acceptable	Field Replicates: Max RPD > LOR x 4 ?	Num Reported	Acceptable
SOIL	Emerald Hand	Moisture - Total	Moisture - Total		1	Other	14 to 21	Y		0	N		0	N		0	N		0	N		0	N		0	N		0	N
SOIL	Emerald Hand	Chemistry	Chemistry		0	Other	3 to 7	3 to 21	Y	98 to 107	2	Y	ND	2	Y		0	N		0	N		0	N		0	N		0	N
SOIL	Emerald Hand	Ethylbenzene (Total)	Ethylbenzene (Total)		0	Other	3 to 7	3 to 21	Y	97 to 112	2	Y	ND	2	Y		0	N		0	N		0	N		0	N		0	N
SOIL	Emerald Hand	Copper	Copper		0	Other	3 to 7	3 to 21	Y	95 to 113	2	Y	ND	2	Y		0	N		0	N		0	N		0	N		0	N
SOIL	Emerald Hand	Lead	Lead		0	Other	3 to 7	3 to 21	Y	93 to 109	2	Y	ND	2	Y		0	N		0	N		0	N		0	N		0	N
SOIL	Emerald Hand	Mercury (inorganic)	Mercury (inorganic)		0	Other	3 to 7	3 to 21	Y	97 to 109	2	Y	ND	2	Y		0	N		0	N		0	N		0	N		0	N
SOIL	Emerald Hand	Nickel	Nickel		0	Other	3 to 7	3 to 21	Y	96 to 111	2	Y	ND	2	Y		0	N		0	N		0	N		0	N		0	N
SOIL	Emerald Hand	Zinc	Zinc		0	Other	3 to 7	3 to 21	Y	90 to 113	2	Y	ND	2	Y		0	N		0	N		0	N		0	N		0	N
SOIL	Asbestos	Asbestos	ACM - Comment		54	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		AF - Comment		54	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Approx. Sample Mass		51	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Asbestos Trace ACM/FA Soil		54	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Asbestos Trace FA & AF in Soil		54	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Asbestos Required Y/N		54	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Asbestos Sample Dimensions		2	SVOC	1 to 2	3 to 21	N		0			3			0	N		0	N		0	N		0			0	N
SOIL	Asbestos		FA - Comment		51	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Mass ACM		54	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Mass AF		54	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Mass Asbestos in ACM		54	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Mass Asbestos in AF		54	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Mass Asbestos in FA & AF		54	Other	1 to 13	3 to 21	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Mass FA		54	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Organic Fibres - Comment		54	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Respirable Fibres - Comment		51	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos		Synthetic Fibres - Comment		54	Other	1 to 13	3 to 13	Y		0			3			0	N		0	N		0	N		0			3	Y
SOIL	Asbestos	Asbestos ID - soils	Asbestos ID in Soil		0	Other	12	12	Y		0			3			0	N		0	N		0	N		0			0	N
SOIL	Asbestos ID - soils	Asbestos ID - soils NEPM	ACM > 7mm Estimate		0	Other		5	Y		0			3			0	N		0	N		0	N		0			0	N
SOIL	Asbestos ID - soils NEPM		Asbestos ID in Soil		0	Other	8	8	Y		0			3			0	N		0	N		0	N		0			0	N
SOIL	Asbestos ID - soils NEPM		Trace Analysis		0	Other		8	Y		0			3			0	N		0	N		0	N		0			0	N
SOIL	Asbestos ID - soils NEPM		Weight of Asbestos		0	Other		8	Y		0			3			0	N		0	N		0	N		0			0	N
SOIL	Asbestos ID - soils NEPM																												
SOIL	Heavy Metal	Arsenic (Total)	Arsenic (Total)	2 mg/kg	10	Other	7 to 13	3 to 21	Y	90 to 111	3	Y	ND	3	Y	1Y	8	Y		0	N		0	N	52 to 128	4	Y	0	25	3	N
SOIL	Heavy Metal	Beryllium	Beryllium	0.1 mg/kg	10	Other	3 to 7	3 to 21	Y	97 to 112	3	Y	ND	3	Y		8	Y		0	N		0	N	52 to 126	4	Y	0	22	3	Y
SOIL	Heavy Metal	Chromium (total)	Chromium (total)	2 mg/kg	10	Other	3 to 7	3 to 21	Y	97 to 112	3	Y	ND	3	Y	1Y	8	Y		0	N		0	N	52 to 124	4	N	0	59	3	Y
SOIL	Heavy Metal	Cobalt	Cobalt	5 mg/kg	10	Other	3 to 7	3 to 21	Y	93 to 105	3	Y	ND	3	Y	1Y	8	Y		0	N		0	N	55 to 123	4	N	0	55	3	Y
SOIL	Heavy Metal	Lead	Lead	5 mg/kg	10	Other	3 to 7	3 to 21	Y	90 to 111	3	Y	ND	3	Y	1Y	8	Y		0	N		0	N	78 to 117	4	Y	0	35	3	Y
SOIL	Heavy Metal	Mercury (inorganic)	Mercury (inorganic)	0.1 mg/kg	10	Other	3 to 7	3 to 21	Y	90 to 105	3	Y	ND	3	Y		8	Y		0	N		0	N	89 to 92	4	Y	0		3	Y
SOIL	Heavy Metal	Nickel	Nickel	5 mg/kg	10	Other	3 to 7	3 to 21	Y	92 to 107	3	Y	ND	3	Y	1Y	8	Y		0	N		0	N	57 to 122	4	N	0	39	3	N
SOIL	Heavy Metal	Zinc	Zinc	5 mg/kg	10	Other	3 to 7	3 to 21	Y	91 to 109	3	Y	ND	3	Y	0	8	Y		0	N		0	N	73 to 81	4	Y	0	19	3	N
SOIL	Heavy Metal																												
SOIL	Inorganic	Inorganic	% Moisture (dried)	1 %	54	Other	1 to 28	5 to 28	Y		0			3		1N	8	Y		0	N		0	N		0			83	3	N
SOIL	Inorganic																												
SOIL	Moisture	Moisture	Moisture		0	Other	3 to 7	9 to 21	Y		0			3			0	N		0	N		0	N		0			0	N
SOIL	Moisture																												
SOIL	OCP	OCP	4,4-DDE	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	107 to 114	3	Y	ND	3	Y		1	Y		0	N		0	N	80 to 121	3	Y	0		3	Y
SOIL	OCP		Aldrin	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	103 to 106	3		ND	3	Y		1	Y		0	N		0	N	86 to 126	3		0		3	Y
SOIL	OCP		Aldrin + Dieldrin (sum of "Aldrin" and "Dieldrin")	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N		0			3			0	N		0	N		0	N		0			0	N
SOIL	OCP		Alpha-BHC	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	97 to 125	3		ND	3	Y		1	Y		0	N		0	N	94 to 123	3		0		3	Y
SOIL	OCP		Beta-BHC	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	108 to 115	3		ND	3	Y		1	Y		0	N		0	N	81 to 117	3		0		3	Y
SOIL	OCP		Chlordane	0.1 mg/kg	11	SVOC	7 to 13	9 to 21	N		0			3			0	N		0	N		0	N		0			0	N
SOIL	OCP		DDD	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	96 to 105	3		ND	3	Y		1	Y		0	N		0	N	82 to 122	3		0		3	Y
SOIL	OCP		DDE	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	93 to 103	3		ND	3	Y		1	Y		0	N		0	N	85 to 123	3		0		3	Y
SOIL	OCP		DDT	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	102 to 112	3		ND	3	Y		1	Y		0	N		0	N		0			0	N
SOIL	OCP		DDT+DDE+DDD (sum of Total)	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N		0			3			0	N		0	N		0	N		0			0	N
SOIL	OCP		Dieldrin	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	98 to 109	3		ND	3	Y		1	Y		0	N		0	N	84 to 118	3		0		3	Y
SOIL	OCP		Endosulfan I	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	97 to 107	3		ND	3	Y		1	Y		0	N		0	N	78 to 117	3		0		3	Y
SOIL	OCP		Endosulfan II	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	100 to 112	3		ND	3	Y		1	Y		0	N		0	N	81 to 124	3		0		3	Y
SOIL	OCP		Endosulfan Sulphate	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	107 to 115	3		ND	3	Y		1	Y		0	N		0	N	87 to 120	3		0		3	Y
SOIL	OCP		Endosulfan Total	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N		0			3			0	N		0	N		0	N		0			0	N
SOIL	OCP		Endrin	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	99 to 121	3		ND	3	Y		1	Y		0	N		0	N	82 to 123	3		0		3	Y
SOIL	OCP		Endrin aldehyde	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	97 to 127	3		ND	3	Y		1	Y		0	N		0	N	81 to 124	3		0		3	Y
SOIL	OCP		Endrin ketone	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	107 to 115	3		ND	3	Y		1	Y		0	N		0	N	87 to 120	3		0		3	Y
SOIL	OCP		Heptachlor	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	98 to 107	3		ND	3	Y		1	Y		0	N		0	N	82 to 118	3		0		3	Y
SOIL	OCP		Heptachlor Epoxide	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	92 to 107	3		ND	3	Y		1	Y		0	N		0	N	82 to 118	3		0		3	Y
SOIL	OCP		Hexachlorobenzene	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	92 to 107	3		ND	3	Y		1	Y		0	N		0	N	82 to 118	3		0		3	Y
SOIL	OCP		Methoxychlor	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	99 to 121	3		ND	3	Y		1	Y		0	N		0	N	82 to 124	3		0		3	Y
SOIL	OCP		Toxaphene	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	100 to 122	3		ND	3	Y		1	Y		0	N		0	N	87 to 120	3		0		3	Y
SOIL	OCP		Trans-Nonachlor	0.25 mg/kg	11	SVOC	7 to 13	9 to 21	N	107 to 115	3		ND	3	Y		1	Y		0	N		0	N	87 to 120	3		0		3	Y
SOIL	OCP		Vinclozolin	0.1 mg/kg	11	SVOC	1 to 7	3 to 21	Y		0			3			0	N		0	N		0	N		0			0	N
SOIL	OCP		Other Chlorinated Pesticides (OCPs)	0.1 mg/kg	11	SVOC	1 to 7	3 to 21	Y		0			3			0	N		0	N		0	N		0			0	N
SOIL	OCP		Sum of OCP Pesticides		1	SVOC			Y		0			0			0	N		0	N		0	N		0			0	N
SOIL	OCP		Sum of OCP Pesticides (WA Only)

SOIL Field Duplicates (SOIL)
Filter: ALL

				SDG	583794	583794		582994	582994		584142	584142		583794
				Field ID	TP12_0.0-0.1	QA20180202-03	RPD	TP34-0.0-0.1	QA20180201-01	RPD	TP18-0.0-0.1	QA20180202-01	RPD	TP12_0.0-0.1
				Sampled Date/Time	2/02/2018	2/02/2018		1/02/2018	1/02/2018		2/02/2018	2/02/2018		2/02/2018
Filter	Method_T	ChemName	Units	EQL										
OCP	OCP	Organochlorine Pesticides EPAVic	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
OCP		Other Organochlorine Pesticides EP	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
OCP														
Heavy Met	Heavy Met	Arsenic (Total)	mg/kg	2 (Primary): 4 (Interlab)	6.4	6.9	8	7.6	7.5	1	**12.0**	**7.6**	**45**	**6.4**
Heavy Met		Cadmium	mg/kg	0.4	<0.4	<0.4	0	<0.4	<0.4	0	<0.4	0.5	22	<0.4
Heavy Met		Chromium (Total)	mg/kg	5 (Primary): 1 (Interlab)	19.0	24.0	23	13.0	17.0	27	**35.0**	**19.0**	**59**	19.0
Heavy Met		Copper	mg/kg	5 (Primary): 1 (Interlab)	7.3	7.9	8	25.0	30.0	18	25.0	30.0	18	7.3
Heavy Met		Lead	mg/kg	5 (Primary): 1 (Interlab)	27.0	30.0	11	38.0	49.0	25	83.0	69.0	18	27.0
Heavy Met		Mercury (Inorganic)	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Heavy Met		Nickel	mg/kg	5 (Primary): 1 (Interlab)	<5.0	<5.0	0	11.0	14.0	24	**9.7**	**14.0**	**36**	<5.0
Heavy Met		Zinc	mg/kg	5 (Primary): 1 (Interlab)	19.0	24.0	23	**150.0**	**210.0**	**33**	**130.0**	**270.0**	**70**	19.0
Heavy Metal														
Organic	Organic	C6-C9 Fraction	mg/kg	20 (Primary): 25 (Interlat	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<20.0	0	<20.0
Organic														
TPH	TPH	C10-C14 Fraction	mg/kg	20 (Primary): 50 (Interlat	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<20.0	0	<20.0
TPH		C15-C28 Fraction	mg/kg	50 (Primary): 100 (Interla	<50.0	<50.0	0	<50.0	<50.0	0	**440.0**	**<50.0**	**159**	<50.0
TPH		C29-C36 Fraction	mg/kg	50 (Primary): 100 (Interla	<50.0	<50.0	0	<50.0	<50.0	0	**290.0**	**<50.0**	**141**	<50.0
TPH		C10-C36 Fraction (Total)	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0	**730.0**	**<50.0**	**174**	<50.0
TPH														
Organic	Organic	>C10-C16 Fraction	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0	<50.0	<50.0	0	<50.0
Organic		>C16-C34 Fraction	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0	0	**590.0**	**<100.0**	**142**	<100.0
Organic		>C34-C40 Fraction	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0	0	**180.0**	**<100.0**	**57**	<100.0
Organic		>C10-C16 less Naphthalene (F2)	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0	<50.0	<50.0	0	<50.0
Organic		C6-C10 Fraction	mg/kg	20 (Primary): 25 (Interlat	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<20.0	0	<20.0
Organic		C6-C10 less BTEX (F1)	mg/kg	20 (Primary): 25 (Interlat	<20.0	<20.0	0	<20.0	<20.0	0	<20.0	<20.0	0	<20.0
Organic														
Volatile	Volatile	Benzene	mg/kg	0.1 (Primary): 0.2 (Interla	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Volatile		Ethylbenzene	mg/kg	0.1 (Primary): 1 (Interlab	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Volatile		Toluene	mg/kg	0.1 (Primary): 0.5 (Interla	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Volatile		Xylene (o)	mg/kg	0.1 (Primary): 1 (Interlab	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
Volatile		Xylene (m & p)	mg/kg	0.2 (Primary): 2 (Interlab	<0.2	<0.2	0	<0.2	<0.2	0	<0.2	<0.2	0	<0.2
Volatile		Xylene (Total)	mg/kg	0.3 (Primary): 1 (Interlab	<0.3	<0.3	0	<0.3	<0.3	0	<0.3	<0.3	0	<0.3
Volatile														
Organic	Organic	Naphthalene	mg/kg	0.5 (Primary): 1 (Interlab	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5
Organic														
PAH	PAH	Acenaphthene	mg/kg	0.5 (Primary): 0.1 (Interla	<0.5	<0.5	0	<0.5	<0.5	0	**1.1**	**<0.5**	**75**	<0.5
PAH		Acenaphthylene	mg/kg	0.5 (Primary): 0.1 (Interla	<0.5	<0.5	0	<0.5	<0.5	0	**0.8**	**<0.5**	**46**	<0.5
PAH		Anthracene	mg/kg	0.5 (Primary): 0.1 (Interla	<0.5	<0.5	0	<0.5	<0.5	0	**4.2**	**<0.5**	**157**	<0.5
PAH		Benz(a)anthracene	mg/kg	0.5 (Primary): 0.1 (Interla	<0.5	<0.5	0	<0.5	<0.5	0	**9.8**	**<0.5**	**181**	<0.5
PAH		Benzo(a)pyrene	mg/kg	0.5 (Primary): 0.05 (Inter	<0.5	<0.5	0	<0.5	<0.5	0	**18.0**	**<0.5**	**189**	<0.5
PAH		Benzo(a)pyrene TEQ (lower bound)	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	**25.0**	**<0.5**	**192**	<0.5
PAH		Benzo(a)pyrene TEQ (medium boun	mg/kg	0.5	0.6	0.6	0	0.6	0.6	0	**25.0**	**0.6**	**191**	0.6
PAH		Benzo(a)pyrene TEQ (upper bound)	mg/kg	0.5	1.2	1.2	0	1.2	1.2	0	**25.0**	**1.2**	**182**	**1.2**
PAH		Benzo(b,j)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	**10.0**	**<0.5**	**181**	<0.5
PAH		Benzo(g,h,i)perylene	mg/kg	0.5 (Primary): 0.1 (Interla	<0.5	<0.5	0	<0.5	<0.5	0	**3.5**	**<0.5**	**150**	<0.5
PAH		Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	**9.4**	**<0.5**	**180**	<0.5
PAH		Chrysene	mg/kg	0.5 (Primary): 0.1 (Interla	<0.5	<0.5	0	<0.5	<0.5	0	**11.0**	**<0.5**	**183**	<0.5
PAH		Dibenz(a,h)anthracene	mg/kg	0.5 (Primary): 0.1 (Interla	<0.5	<0.5	0	<0.5	<0.5	0	**3.3**	**<0.5**	**147**	<0.5
PAH		Fluoranthene	mg/kg	0.5 (Primary): 0.1 (Interla	<0.5	<0.5	0	<0.5	<0.5	0	**28.0**	**<0.5**	**193**	<0.5
PAH		Fluorene	mg/kg	0.5 (Primary): 0.1 (Interla	<0.5	<0.5	0	<0.5	<0.5	0	**1.8**	**<0.5**	**113**	<0.5

Filter: ALL

Document Set ID: 8477747
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SOIL Field Duplicates (SOIL)
Filter: ALL

				SDG	583794	583794		582994	582994		584142	584142		583794
				Field ID	TP12_0.0-0.1	QA20180202-03	RPD	TP34-0.0-0.1	QA20180201-01	RPD	TP18-0.0-0.1	QA20180202-01	RPD	TP12_0.0-0.1
				Sampled Date/Time	2/02/2018	2/02/2018		1/02/2018	1/02/2018		2/02/2018	2/02/2018		2/02/2018
PAH		Indeno(1,2,3-c,d)pyrene	mg/kg	0.5 (Primary): 0.1 (Interla	<0.5	<0.5	0	<0.5	<0.5	0	**11.0**	**<0.5**	**183**	<0.5
PAH		Naphthalene	mg/kg	0.5 (Primary): 1 (Interlab	<0.5	<0.5	0	<0.5	<0.5	0	0.6	<0.5	18	<0.5
PAH		Phenanthrene	mg/kg	0.5 (Primary): 0.1 (Interla	<0.5	<0.5	0	<0.5	<0.5	0	**24.0**	**<0.5**	**192**	<0.5
PAH		Pyrene	mg/kg	0.5 (Primary): 0.1 (Interla	<0.5	<0.5	0	<0.5	<0.5	0	**26.0**	**<0.5**	**192**	<0.5
PAH		PAHs (Total)	mg/kg	0.5 (Primary): 0.05 (Inter	<0.5	<0.5	0	<0.5	<0.5	0	**162.5**	**<0.5**	**199**	**<0.5**
PAH														
OCP	OCP	Hexachlorobenzene	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP														
PCB	PCB	Arodor 1016	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
PCB		Arodor 1221	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
PCB		Arodor 1232	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
PCB		Arodor 1242	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
PCB		Arodor 1248	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
PCB		Arodor 1254	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
PCB		Arodor 1260	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
PCB		PCBs (Total)	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
PCB														
OCP	OCP	4,4-DDE	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Aldrin	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Aldrin + Dieldrin (Sum of Total)	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		alpha-BHC	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		beta-BHC	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Dieldrin	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		DDD	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		DDT	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		DDT+DDE+DDD (Sum of Total)	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Chlordane	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1
OCP		delta-BHC	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Endosulfan alpha	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Endosulfan beta	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Endosulfan sulphate	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Endrin	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Endrin aldehyde	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Endrin ketone	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Heptachlor	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Heptachlor Epoxide	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Lindane	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Methoxychlor	mg/kg	0.05 (Primary): 0.1 (Inter	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05
OCP		Toxaphene	mg/kg	1	<1.0	<1.0	0	<1.0	<1.0	0	<1.0	<1.0	0	<1.0
OCP														
Asbestos	Asbestos	Approx. Sample Mass	G		817.0	749.0	9	601.0	816.0	30	750.0	726.0	3	817.0
Asbestos		Asbestos from ACM in Soil	%w/w		0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0
Asbestos		Asbestos from FA & AF in Soil	%w/w		0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0
Asbestos		Mass ACM	G		0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0
Asbestos		Mass Asbestos in ACM	G		0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0
Asbestos		Mass FA	G		0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0
Asbestos		Mass Asbestos in FA	G		0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0
Asbestos		Mass AF	G		0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0
Asbestos		Mass Asbestos in AF	G		0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0
Asbestos		Asbestos Reported Result	COMMENT		1.0	1.0	0	1.0	1.0	0	1.0	1.0	0	1.0
Asbestos		Mass Asbestos in FA & AF	G		0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0

Filter: ALL

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SOIL Field Duplicates (SOIL)
Filter: ALL

					SDG	583794	583794		582994	582994		584142	584142		583794
					Field ID	TP12_0.0-0.1	QA20180202-03	RPD	TP34-0.0-0.1	QA20180201-01	RPD	TP18-0.0-0.1	QA20180202-01	RPD	TP12_0.0-0.1
					Sampled Date/Time	2/02/2018	2/02/2018		1/02/2018	1/02/2018		2/02/2018	2/02/2018		2/02/2018
Asbestos		ACM - Comment	COMMENT			1.0	1.0	0	1.0	1.0	0	1.0	1.0	0	1.0
Asbestos		AF - Comment	COMMENT			1.0	1.0	0	1.0	1.0	0	1.0	1.0	0	1.0
Asbestos		FA - Comment	COMMENT			1.0	1.0	0	1.0	1.0	0	1.0	1.0	0	1.0
Asbestos		Organic Fibres - Comment	COMMENT			1.0	1.0	0	1.0	1.0	0	1.0	1.0	0	1.0
Asbestos		Respirable Fibres - Comment	COMMENT			1.0	1.0	0	1.0	1.0	0	1.0	1.0	0	1.0
Asbestos		Synthetic Fibres - Comment	COMMENT			1.0	1.0	0	1.0	1.0	0	1.0	1.0	0	1.0
Asbestos															
Inorganic	Inorganic	% Moisture 103oC	%	1		8.1	9.1	12	2.5	2.5	0	**8.6**	**3.6**	**82**	8.1

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 30 (1-20 x EQL); 30 (20-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Filter: ALL

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Field Duplicates (SOIL)
Filter: ALL

	SDG	ENVIROLAB 2018-02-09T00:00:00			582994	ENVIROLAB 2018-02-05T00:00:00		
	Field ID	QC20180202-03	**RPD**		TP34-0.0-0.1	QC20180201-01	**RPD**	
	Sampled Date/Time	2/02/2018			1/02/2018	1/02/2018		
Method_T	**ChemName**	**Units**	**EQL**					
OCP	Organochlorine Pesticides EPAVic	mg/kg	0.1			<0.1		
	Other Organochlorine Pesticides EP	mg/kg	0.1			<0.1		
Heavy Met	Arsenic (Total)	mg/kg	2 (Primary): 4 (Interlab)	**4.0**	**46**	**7.6**	**5.0**	**41**
	Cadmium	mg/kg	0.4	<0.4	0	<0.4	<0.4	0
	Chromium (Total)	mg/kg	5 (Primary): 1 (Interlab)	16.0	17	**13.0**	**18.0**	**32**
	Copper	mg/kg	5 (Primary): 1 (Interlab)	6.0	20	**25.0**	**16.0**	**44**
	Lead	mg/kg	5 (Primary): 1 (Interlab)	22.0	20	38.0	47.0	21
	Mercury (Inorganic)	mg/kg	0.1	<0.1	0	<0.1	<0.1	0
	Nickel	mg/kg	5 (Primary): 1 (Interlab)	3.0	0	**11.0**	**6.0**	**59**
	Zinc	mg/kg	5 (Primary): 1 (Interlab)	16.0	17	**150.0**	**110.0**	**31**
al								
Organic	C6-C9 Fraction	mg/kg	20 (Primary): 25 (Interla	<25.0	0	<20.0	<25.0	0
TPH	C10-C14 Fraction	mg/kg	20 (Primary): 50 (Interla	<50.0	0	<20.0	<50.0	0
	C15-C28 Fraction	mg/kg	50 (Primary): 100 (Interl	<100.0	0	**<50.0**	**350.0**	**150**
	C29-C36 Fraction	mg/kg	50 (Primary): 100 (Interl	<100.0	0	**<50.0**	**300.0**	**143**
	C10-C36 Fraction (Total)	mg/kg	50	<50.0	0	<50.0		
Organic	>C10-C16 Fraction	mg/kg	50	<50.0	0	<50.0	<50.0	0
	>C16-C34 Fraction	mg/kg	100	<100.0	0	**<100.0**	**570.0**	**140**
	>C34-C40 Fraction	mg/kg	100	<100.0	0	**<100.0**	**180.0**	**57**
	>C10-C16 less Naphthalene (F2)	mg/kg	50	<50.0	0	<50.0	<50.0	0
	C6-C10 Fraction	mg/kg	20 (Primary): 25 (Interla	<25.0	0	<20.0	<25.0	0
	C6-C10 less BTEX (F1)	mg/kg	20 (Primary): 25 (Interla	<25.0	0	<20.0	<25.0	0
Volatile	Benzene	mg/kg	0.1 (Primary): 0.2 (Interl	<0.2	0	<0.1	<0.2	0
	Ethylbenzene	mg/kg	0.1 (Primary): 1 (Interlab	<1.0	0	<0.1	<1.0	0
	Toluene	mg/kg	0.1 (Primary): 0.5 (Interl	<0.5	0	<0.1	<0.5	0
	Xylene (o)	mg/kg	0.1 (Primary): 1 (Interlab	<1.0	0	<0.1	<1.0	0
	Xylene (m & p)	mg/kg	0.2 (Primary): 2 (Interlab	<2.0	0	<0.2	<2.0	0
	Xylene (Total)	mg/kg	0.3 (Primary): 1 (Interlab	<1.0	0	<0.3	<1.0	0
Organic	Naphthalene	mg/kg	0.5 (Primary): 1 (Interlab	<0.1	0	**<0.5**	**<1.0 - 3.0**	**143**
PAH	Acenaphthene	mg/kg	0.5 (Primary): 0.1 (Interl	<0.1	0	**<0.5**	**1.2**	**82**
	Acenaphthylene	mg/kg	0.5 (Primary): 0.1 (Interl	<0.1	0	**<0.5**	**2.3**	**129**
	Anthracene	mg/kg	0.5 (Primary): 0.1 (Interl	<0.1	0	**<0.5**	**6.4**	**171**
	Benz(a)anthracene	mg/kg	0.5 (Primary): 0.1 (Interl	0.2	0	**<0.5**	**11.0**	**183**
	Benzo(a)pyrene	mg/kg	0.5 (Primary): 0.05 (Inter	0.25	0	**<0.5**	**15.0**	**187**
	Benzo(a)pyrene TEQ (lower bound)	mg/kg	0.5			**<0.5**	**22.0**	**191**
	Benzo(a)pyrene TEQ (medium boun	mg/kg	0.5	<0.5	18	**0.6**	**22.0**	**189**
	Benzo(a)pyrene TEQ (upper bound)	mg/kg	0.5	**<0.5**	**82**	**1.2**	**22.0**	**179**
	Benzo(b,j)fluoranthene	mg/kg	0.5			<0.5		
	Benzo(g,h,i)perylene	mg/kg	0.5 (Primary): 0.1 (Interl	0.2	0	**<0.5**	**13.0**	**185**
	Benzo(k)fluoranthene	mg/kg	0.5			<0.5		
	Chrysene	mg/kg	0.5 (Primary): 0.1 (Interl	0.2	0	**<0.5**	**10.0**	**181**
	Dibenz(a,h)anthracene	mg/kg	0.5 (Primary): 0.1 (Interl	<0.1	0	**<0.5**	**2.7**	**138**
	Fluoranthene	mg/kg	0.5 (Primary): 0.1 (Interl	0.4	0	**<0.5**	**38.0**	**195**
	Fluorene	mg/kg	0.5 (Primary): 0.1 (Interl	<0.1	0	**<0.5**	**2.7**	**138**

Filter: ALL

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Field Duplicates (SOIL)
Filter: ALL

			SDG	ENVIROLAB 2018-02-09T00:00:00		582994	ENVIROLAB 2018-02-05T00:00:00	
			Field ID	QC20180202-03	RPD	TP34-0.0-0.1	QC20180201-01	RPD
			Sampled Date/Time	2/02/2018		1/02/2018	1/02/2018	
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5 (Primary): 0.1 (Interl	0.2	0	**<0.5**	**10.0**	**181**
	Naphthalene	mg/kg	0.5 (Primary): 1 (Interlab	<0.1	0	**<0.5**	**<1.0 - 3.0**	**143**
	Phenanthrene	mg/kg	0.5 (Primary): 0.1 (Interl	0.2	0	**<0.5**	**31.0**	**194**
	Pyrene	mg/kg	0.5 (Primary): 0.1 (Interl	0.4	0	**<0.5**	**35.0**	**194**
	PAHs (Total)	mg/kg	0.5 (Primary): 0.05 (Inte	**2.3**	**129**	<0.5		
OCP	Hexachlorobenzene	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
PCB	Aroclor 1016	mg/kg	0.1	<0.1	0	<0.1	<0.5	0
	Aroclor 1221	mg/kg	0.1	<0.1	0	<0.1	<0.5	0
	Aroclor 1232	mg/kg	0.1	<0.1	0	<0.1	<0.5	0
	Aroclor 1242	mg/kg	0.1	<0.1	0	<0.1	<0.5	0
	Aroclor 1248	mg/kg	0.1	<0.1	0	<0.1	<0.5	0
	Aroclor 1254	mg/kg	0.1	<0.1	0	<0.1	<0.5	0
	Aroclor 1260	mg/kg	0.1	<0.1	0	<0.1	<0.5	0
	PCBs (Total)	mg/kg	0.1	<0.1	0	<0.1	<0.5	0
OCP	4,4-DDE	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Aldrin	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Aldrin + Dieldrin (Sum of Total)	mg/kg	0.05			<0.05		
	alpha-BHC	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	beta-BHC	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Dieldrin	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	DDD	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	DDT	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	DDT+DDE+DDD (Sum of Total)	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Chlordane	mg/kg	0.1			<0.1		
	delta-BHC	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Endosulfan alpha	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Endosulfan beta	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Endosulfan sulphate	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Endrin	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Endrin aldehyde	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Endrin ketone	mg/kg	0.05			<0.05		
	Heptachlor	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Heptachlor Epoxide	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Lindane	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Methoxychlor	mg/kg	0.05 (Primary): 0.1 (Inte	<0.1	0	<0.05	<0.1	0
	Toxaphene	mg/kg	1			<1.0		
Asbestos	Approx. Sample Mass	G				601.0		
	Asbestos from ACM in Soil	%w/w				0.0		
	Asbestos from FA & AF in Soil	%w/w				0.0		
	Mass ACM	G				0.0		
	Mass Asbestos in ACM	G				0.0		
	Mass FA	G				0.0		
	Mass Asbestos in FA	G				0.0		
	Mass AF	G				0.0		
	Mass Asbestos in AF	G				0.0		
	Asbestos Reported Result	COMMENT				1.0		
	Mass Asbestos in FA & AF	G				0.0		

Filter: ALL

Field Duplicates (SOIL)
Filter: ALL

	SDG	ENVIROLAB 2018-02-09T00:00:00			582994	ENVIROLAB 2018-02-05T00:00:00			
	Field ID	QC20180202-03		**RPD**	TP34-0.0-0.1	QC20180201-01		**RPD**	
	Sampled Date/Time	2/02/2018			1/02/2018	1/02/2018			
	ACM - Comment	COMMENT				1.0			
	AF - Comment	COMMENT				1.0			
	FA - Comment	COMMENT				1.0			
	Organic Fibres - Comment	COMMENT				1.0			
	Respirable Fibres - Comment	COMMENT				1.0			
	Synthetic Fibres - Comment	COMMENT				1.0			
Inorganic	% Moisture 103oC	%	1			2.5			

*RPDs have only been considered where a concentration is greater than 1 times the l
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 30 (1-2
***Interlab Duplicates are matched on a per compound basis as methods vary betwee

Filter: ALL

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Appendix G Chain of Custody and Laboratory Reports

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Certificate of Analysis

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Katie Linz**

Report **582994-S**
Project name ST MARYS PSI
Project ID 54340
Received Date Feb 02, 2018

Client Sample ID			**TP23-0-0.1**	**TP24-0.2-0.3**	**TP25-0-0.1**	**TP26-0.2-0.3**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S18-Fe02463**	**S18-Fe02464**	**S18-Fe02465**	**S18-Fe02466**
Date Sampled			**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	-	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	-	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	-	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	-	< 50
TRH C10-36 (Total)	50	mg/kg	< 50	< 50	-	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	-	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	-	< 0.3
4-Bromofluorobenzene (surr.)	1	%	109	106	-	112
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	-	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	-	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	-	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	-	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	-	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	-	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	< 0.5	0.7	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	0.6	1.0	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	1.2	1.3	1.2
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 0.5	0.6	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 0.5	0.6	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	< 0.5	0.5	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Chrysene	0.5	mg/kg	< 0.5	< 0.5	0.7	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5

Client Sample ID			TP23-0-0.1	TP24-0.2-0.3	TP25-0-0.1	TP26-0.2-0.3
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02463	S18-Fe02464	S18-Fe02465	S18-Fe02466
Date Sampled			Feb 01, 2018	Feb 01, 2018	Feb 01, 2018	Feb 01, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Fluoranthene	0.5	mg/kg	< 0.5	< 0.5	1.3	1.3
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	< 0.5	0.6	0.5
Pyrene	0.5	mg/kg	< 0.5	< 0.5	1.4	1.1
Total PAH*	0.5	mg/kg	< 0.5	< 0.5	5.7	2.9
2-Fluorobiphenyl (surr.)	1	%	85	86	95	86
p-Terphenyl-d14 (surr.)	1	%	91	96	90	101
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	-	-	-
4.4'-DDD	0.05	mg/kg	< 0.05	-	-	-
4.4'-DDE	0.05	mg/kg	< 0.05	-	-	-
4.4'-DDT	0.05	mg/kg	< 0.05	-	-	-
a-BHC	0.05	mg/kg	< 0.05	-	-	-
Aldrin	0.05	mg/kg	< 0.05	-	-	-
b-BHC	0.05	mg/kg	< 0.05	-	-	-
d-BHC	0.05	mg/kg	< 0.05	-	-	-
Dieldrin	0.05	mg/kg	< 0.05	-	-	-
Endosulfan I	0.05	mg/kg	< 0.05	-	-	-
Endosulfan II	0.05	mg/kg	< 0.05	-	-	-
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	-	-
Endrin	0.05	mg/kg	< 0.05	-	-	-
Endrin aldehyde	0.05	mg/kg	< 0.05	-	-	-
Endrin ketone	0.05	mg/kg	< 0.05	-	-	-
g-BHC (Lindane)	0.05	mg/kg	< 0.05	-	-	-
Heptachlor	0.05	mg/kg	< 0.05	-	-	-
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	-	-
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	-	-
Methoxychlor	0.05	mg/kg	< 0.05	-	-	-
Toxaphene	1	mg/kg	< 1	-	-	-
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	-	-	-
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	-	-	-
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	-	-	-
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	-	-	-
Dibutylchlorendate (surr.)	1	%	129	-	-	-
Tetrachloro-m-xylene (surr.)	1	%	126	-	-	-
Polychlorinated Biphenyls						
Aroclor-1016	0.1	mg/kg	< 0.1	-	-	-
Aroclor-1221	0.1	mg/kg	< 0.1	-	-	-
Aroclor-1232	0.1	mg/kg	< 0.1	-	-	-
Aroclor-1242	0.1	mg/kg	< 0.1	-	-	-
Aroclor-1248	0.1	mg/kg	< 0.1	-	-	-
Aroclor-1254	0.1	mg/kg	< 0.1	-	-	-
Aroclor-1260	0.1	mg/kg	< 0.1	-	-	-
Total PCB*	0.1	mg/kg	< 0.1	-	-	-
Dibutylchlorendate (surr.)	1	%	129	-	-	-
Tetrachloro-m-xylene (surr.)	1	%	126	-	-	-

Client Sample ID			TP23-0-0.1	TP24-0.2-0.3	TP25-0-0.1	TP26-0.2-0.3
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S18-Fe02463**	**S18-Fe02464**	**S18-Fe02465**	**S18-Fe02466**
Date Sampled			**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	2	mg/kg	3.9	2.8	5.8	22
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	12	9.0	27	150
Copper	5	mg/kg	14	7.0	29	6.6
Lead	5	mg/kg	45	11	120	36
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	7.1	5.8	11	9.2
Zinc	5	mg/kg	32	7.8	76	8.8
% Moisture	1	%	3.5	4.3	12	5.5

Client Sample ID			TP27-0-0.1	TP28-0-0.1	TP29-0.2-0.3	TP30-0.0-0.1
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S18-Fe02467**	**S18-Fe02468**	**S18-Fe02469**	**S18-Fe02470**
Date Sampled			**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	-	-	< 20
TRH C10-C14	20	mg/kg	< 20	-	-	30
TRH C15-C28	50	mg/kg	100	-	-	690
TRH C29-C36	50	mg/kg	72	-	-	210
TRH C10-36 (Total)	50	mg/kg	172	-	-	930
BTEX						
Benzene	0.1	mg/kg	< 0.1	-	-	< 0.1
Toluene	0.1	mg/kg	< 0.1	-	-	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	-	-	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	-	-	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	-	-	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	-	-	< 0.3
4-Bromofluorobenzene (surr.)	1	%	100	-	-	108
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	-	-	< 0.5
TRH C6-C10	20	mg/kg	< 20	-	-	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	-	-	< 20
TRH >C10-C16	50	mg/kg	< 50	-	-	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	-	-	< 50
TRH >C16-C34	100	mg/kg	150	-	-	760
TRH >C34-C40	100	mg/kg	< 100	-	-	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	2.1	1.5	< 0.5	25
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	2.4	1.8	0.6	25
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	2.6	2.0	1.2	25
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	5.1
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	1.4
Anthracene	0.5	mg/kg	0.6	< 0.5	< 0.5	15
Benz(a)anthracene	0.5	mg/kg	1.8	0.8	< 0.5	21
Benzo(a)pyrene	0.5	mg/kg	1.6	1.2	< 0.5	16
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	1.2	0.7	< 0.5	12

Client Sample ID			TP27-0-0.1	TP28-0-0.1	TP29-0.2-0.3	TP30-0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02467	S18-Fe02468	S18-Fe02469	S18-Fe02470
Date Sampled			Feb 01, 2018	Feb 01, 2018	Feb 01, 2018	Feb 01, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Benzo(g.h.i)perylene	0.5	mg/kg	1.2	1.4	< 0.5	11
Benzo(k)fluoranthene	0.5	mg/kg	1.0	0.6	< 0.5	9.8
Chrysene	0.5	mg/kg	1.7	1.0	< 0.5	18
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	3.5
Fluoranthene	0.5	mg/kg	4.0	1.1	< 0.5	64
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	6.0
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	1.0	1.0	< 0.5	9.1
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	9.3
Phenanthrene	0.5	mg/kg	2.3	< 0.5	< 0.5	87
Pyrene	0.5	mg/kg	3.7	1.2	< 0.5	54
Total PAH*	0.5	mg/kg	20.1	9	< 0.5	342.2
2-Fluorobiphenyl (surr.)	1	%	90	94	61	85
p-Terphenyl-d14 (surr.)	1	%	89	85	67	80
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	-	-	-	< 0.1
4.4'-DDD	0.05	mg/kg	-	-	-	< 0.05
4.4'-DDE	0.05	mg/kg	-	-	-	< 0.05
4.4'-DDT	0.05	mg/kg	-	-	-	< 0.05
a-BHC	0.05	mg/kg	-	-	-	< 0.05
Aldrin	0.05	mg/kg	-	-	-	< 0.05
b-BHC	0.05	mg/kg	-	-	-	< 0.05
d-BHC	0.05	mg/kg	-	-	-	< 0.05
Dieldrin	0.05	mg/kg	-	-	-	< 0.05
Endosulfan I	0.05	mg/kg	-	-	-	< 0.05
Endosulfan II	0.05	mg/kg	-	-	-	< 0.05
Endosulfan sulphate	0.05	mg/kg	-	-	-	< 0.05
Endrin	0.05	mg/kg	-	-	-	< 0.05
Endrin aldehyde	0.05	mg/kg	-	-	-	< 0.05
Endrin ketone	0.05	mg/kg	-	-	-	< 0.05
g-BHC (Lindane)	0.05	mg/kg	-	-	-	< 0.05
Heptachlor	0.05	mg/kg	-	-	-	< 0.05
Heptachlor epoxide	0.05	mg/kg	-	-	-	< 0.05
Hexachlorobenzene	0.05	mg/kg	-	-	-	< 0.05
Methoxychlor	0.05	mg/kg	-	-	-	< 0.05
Toxaphene	1	mg/kg	-	-	-	< 1
Aldrin and Dieldrin (Total)*	0.05	mg/kg	-	-	-	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	-	-	-	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	-	-	-	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	-	-	-	< 0.1
Dibutylchlorendate (surr.)	1	%	-	-	-	83
Tetrachloro-m-xylene (surr.)	1	%	-	-	-	93
Polychlorinated Biphenyls						
Aroclor-1016	0.1	mg/kg	-	-	-	< 0.1
Aroclor-1221	0.1	mg/kg	-	-	-	< 0.1
Aroclor-1232	0.1	mg/kg	-	-	-	< 0.1
Aroclor-1242	0.1	mg/kg	-	-	-	< 0.1
Aroclor-1248	0.1	mg/kg	-	-	-	< 0.1
Aroclor-1254	0.1	mg/kg	-	-	-	< 0.1
Aroclor-1260	0.1	mg/kg	-	-	-	< 0.1

Client Sample ID			TP27-0-0.1	TP28-0-0.1	TP29-0.2-0.3	TP30-0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02467	S18-Fe02468	S18-Fe02469	S18-Fe02470
Date Sampled			Feb 01, 2018	Feb 01, 2018	Feb 01, 2018	Feb 01, 2018
Test/Reference	LOR	Unit				
Polychlorinated Biphenyls						
Total PCB*	0.1	mg/kg	-	-	-	< 0.1
Dibutylchlorendate (surr.)	1	%	-	-	-	83
Tetrachloro-m-xylene (surr.)	1	%	-	-	-	93
Heavy Metals						
Arsenic	2	mg/kg	9.8	6.6	7.5	4.5
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	25	30	7.6	39
Copper	5	mg/kg	17	59	78	56
Lead	5	mg/kg	41	79	58	90
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	5.6	30	19	39
Zinc	5	mg/kg	38	62	76	130
% Moisture	1	%	7.2	3.4	6.3	5.0

Client Sample ID			TP31-0.2-0.3	TP32-0.2-0.3	TP33-0.2-0.3	TP34-0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02471	S18-Fe02472	S18-Fe02473	S18-Fe02474
Date Sampled			Feb 01, 2018	Feb 01, 2018	Feb 01, 2018	Feb 01, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	-	-	< 20
TRH C10-C14	20	mg/kg	< 20	-	-	< 20
TRH C15-C28	50	mg/kg	< 50	-	-	< 50
TRH C29-C36	50	mg/kg	< 50	-	-	< 50
TRH C10-36 (Total)	50	mg/kg	< 50	-	-	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	-	-	< 0.1
Toluene	0.1	mg/kg	< 0.1	-	-	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	-	-	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	-	-	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	-	-	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	-	-	< 0.3
4-Bromofluorobenzene (surr.)	1	%	120	-	-	107
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	-	-	< 0.5
TRH C6-C10	20	mg/kg	< 20	-	-	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	-	-	< 20
TRH >C10-C16	50	mg/kg	< 50	-	-	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	-	-	< 50
TRH >C16-C34	100	mg/kg	< 100	-	-	< 100
TRH >C34-C40	100	mg/kg	< 100	-	-	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	2.4	< 0.5	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	2.4	0.6	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	2.4	1.2	1.2
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5

Client Sample ID			TP31-0.2-0.3	TP32-0.2-0.3	TP33-0.2-0.3	TP34-0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02471	S18-Fe02472	S18-Fe02473	S18-Fe02474
Date Sampled			Feb 01, 2018	Feb 01, 2018	Feb 01, 2018	Feb 01, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	0.9	< 0.5	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	1.3	< 0.5	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	0.9	< 0.5	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	0.5	2.1	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	0.9	< 0.5	< 0.5
Chrysene	0.5	mg/kg	< 0.5	0.9	< 0.5	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	0.7	< 0.5	< 0.5
Fluoranthene	0.5	mg/kg	0.5	1.3	< 0.5	< 0.5
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	1.4	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Pyrene	0.5	mg/kg	0.6	1.3	< 0.5	< 0.5
Total PAH*	0.5	mg/kg	1.6	11.7	< 0.5	< 0.5
2-Fluorobiphenyl (surr.)	1	%	78	105	106	99
p-Terphenyl-d14 (surr.)	1	%	81	92	101	87
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	-	-	-	< 0.1
4.4'-DDD	0.05	mg/kg	-	-	-	< 0.05
4.4'-DDE	0.05	mg/kg	-	-	-	< 0.05
4.4'-DDT	0.05	mg/kg	-	-	-	< 0.05
a-BHC	0.05	mg/kg	-	-	-	< 0.05
Aldrin	0.05	mg/kg	-	-	-	< 0.05
b-BHC	0.05	mg/kg	-	-	-	< 0.05
d-BHC	0.05	mg/kg	-	-	-	< 0.05
Dieldrin	0.05	mg/kg	-	-	-	< 0.05
Endosulfan I	0.05	mg/kg	-	-	-	< 0.05
Endosulfan II	0.05	mg/kg	-	-	-	< 0.05
Endosulfan sulphate	0.05	mg/kg	-	-	-	< 0.05
Endrin	0.05	mg/kg	-	-	-	< 0.05
Endrin aldehyde	0.05	mg/kg	-	-	-	< 0.05
Endrin ketone	0.05	mg/kg	-	-	-	< 0.05
g-BHC (Lindane)	0.05	mg/kg	-	-	-	< 0.05
Heptachlor	0.05	mg/kg	-	-	-	< 0.05
Heptachlor epoxide	0.05	mg/kg	-	-	-	< 0.05
Hexachlorobenzene	0.05	mg/kg	-	-	-	< 0.05
Methoxychlor	0.05	mg/kg	-	-	-	< 0.05
Toxaphene	1	mg/kg	-	-	-	< 1
Aldrin and Dieldrin (Total)*	0.05	mg/kg	-	-	-	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	-	-	-	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	-	-	-	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	-	-	-	< 0.1
Dibutylchlorendate (surr.)	1	%	-	-	-	100
Tetrachloro-m-xylene (surr.)	1	%	-	-	-	102

Client Sample ID			TP31-0.2-0.3	TP32-0.2-0.3	TP33-0.2-0.3	TP34-0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02471	S18-Fe02472	S18-Fe02473	S18-Fe02474
Date Sampled			Feb 01, 2018	Feb 01, 2018	Feb 01, 2018	Feb 01, 2018
Test/Reference	LOR	Unit				
Polychlorinated Biphenyls						
Aroclor-1016	0.1	mg/kg	-	-	-	< 0.1
Aroclor-1221	0.1	mg/kg	-	-	-	< 0.1
Aroclor-1232	0.1	mg/kg	-	-	-	< 0.1
Aroclor-1242	0.1	mg/kg	-	-	-	< 0.1
Aroclor-1248	0.1	mg/kg	-	-	-	< 0.1
Aroclor-1254	0.1	mg/kg	-	-	-	< 0.1
Aroclor-1260	0.1	mg/kg	-	-	-	< 0.1
Total PCB*	0.1	mg/kg	-	-	-	< 0.1
Dibutylchlorendate (surr.)	1	%	-	-	-	100
Tetrachloro-m-xylene (surr.)	1	%	-	-	-	102
Heavy Metals						
Arsenic	2	mg/kg	4.3	5.0	9.6	7.6
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	26	25	13	13
Copper	5	mg/kg	86	76	8.7	25
Lead	5	mg/kg	86	57	6.1	38
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	30	33	< 5	11
Zinc	5	mg/kg	97	94	5.6	150
% Moisture	1	%	5.3	2.8	9.9	2.5

Client Sample ID			TP35-0.0-0.1	TP36-0.2-0.3	TP37-0.2-0.3	TP37-0.9-1.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02475	S18-Fe02476	S18-Fe02477	S18-Fe02478
Date Sampled			Feb 01, 2018	Feb 01, 2018	Feb 01, 2018	Feb 01, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	-	-	< 20	-
TRH C10-C14	20	mg/kg	-	-	< 20	-
TRH C15-C28	50	mg/kg	-	-	< 50	-
TRH C29-C36	50	mg/kg	-	-	< 50	-
TRH C10-36 (Total)	50	mg/kg	-	-	< 50	-
BTEX						
Benzene	0.1	mg/kg	-	-	< 0.1	-
Toluene	0.1	mg/kg	-	-	< 0.1	-
Ethylbenzene	0.1	mg/kg	-	-	< 0.1	-
m&p-Xylenes	0.2	mg/kg	-	-	< 0.2	-
o-Xylene	0.1	mg/kg	-	-	< 0.1	-
Xylenes - Total	0.3	mg/kg	-	-	< 0.3	-
4-Bromofluorobenzene (surr.)	1	%	-	-	104	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	-	-	< 0.5	-
TRH C6-C10	20	mg/kg	-	-	< 20	-
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	-	-	< 20	-
TRH >C10-C16	50	mg/kg	-	-	< 50	-
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	-	-	< 50	-
TRH >C16-C34	100	mg/kg	-	-	< 100	-
TRH >C34-C40	100	mg/kg	-	-	< 100	-

Client Sample ID			TP35-0.0-0.1	TP36-0.2-0.3	TP37-0.2-0.3	TP37-0.9-1.0
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S18-Fe02475**	**S18-Fe02476**	**S18-Fe02477**	**S18-Fe02478**
Date Sampled			**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	< 0.5	0.9	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	0.6	1.2	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	1.2	1.4	1.2
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 0.5	0.7	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 0.5	0.7	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	< 0.5	0.5	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 0.5	0.6	< 0.5
Chrysene	0.5	mg/kg	< 0.5	< 0.5	0.7	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5	< 0.5	2.5	< 0.5
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	< 0.5	3.1	< 0.5
Pyrene	0.5	mg/kg	< 0.5	< 0.5	2.2	< 0.5
Total PAH*	0.5	mg/kg	< 0.5	< 0.5	11	< 0.5
2-Fluorobiphenyl (surr.)	1	%	88	107	93	112
p-Terphenyl-d14 (surr.)	1	%	77	95	80	97
Heavy Metals						
Arsenic	2	mg/kg	3.3	< 2	6.6	7.0
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.5	< 0.4
Chromium	5	mg/kg	46	140	21	21
Copper	5	mg/kg	15	29	22	11
Lead	5	mg/kg	14	8.3	21	12
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	29	84	12	< 5
Zinc	5	mg/kg	47	56	83	9.8
% Moisture	1	%	8.2	7.1	7.6	18

Client Sample ID			TP39-0.0-0.1	TP40-0.0-0.1	SP01-TP01-0.8-0.9	SP02-TP02-3.4-3.5
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S18-Fe02479**	**S18-Fe02480**	**S18-Fe02481**	**S18-Fe02482**
Date Sampled			**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	-	-	< 20
TRH C10-C14	20	mg/kg	< 20	-	-	< 20
TRH C15-C28	50	mg/kg	< 50	-	-	< 50
TRH C29-C36	50	mg/kg	52	-	-	< 50
TRH C10-36 (Total)	50	mg/kg	52	-	-	< 50

Client Sample ID			TP39-0.0-0.1	TP40-0.0-0.1	SP01-TP01-0.8-0.9	SP02-TP02-3.4-3.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02479	S18-Fe02480	S18-Fe02481	S18-Fe02482
Date Sampled			Feb 01, 2018	Feb 01, 2018	Feb 01, 2018	Feb 01, 2018
Test/Reference	LOR	Unit				
BTEX						
Benzene	0.1	mg/kg	< 0.1	-	-	< 0.1
Toluene	0.1	mg/kg	< 0.1	-	-	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	-	-	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	-	-	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	-	-	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	-	-	< 0.3
4-Bromofluorobenzene (surr.)	1	%	105	-	-	118
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	-	-	< 0.5
TRH C6-C10	20	mg/kg	< 20	-	-	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	-	-	< 20
TRH >C10-C16	50	mg/kg	< 50	-	-	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	-	-	< 50
TRH >C16-C34	100	mg/kg	< 100	-	-	< 100
TRH >C34-C40	100	mg/kg	< 100	-	-	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	4.6	< 0.5	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	4.6	0.6	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	4.6	1.2	1.2
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	1.8	< 0.5	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	2.7	< 0.5	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	2.5	< 0.5	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5	2.4	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	2.3	< 0.5	< 0.5
Chrysene	0.5	mg/kg	< 0.5	2.0	< 0.5	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	1.0	< 0.5	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5	1.8	< 0.5	< 0.5
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	2.0	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Pyrene	0.5	mg/kg	< 0.5	2.6	< 0.5	< 0.5
Total PAH*	0.5	mg/kg	< 0.5	21.1	< 0.5	< 0.5
2-Fluorobiphenyl (surr.)	1	%	88	74	88	81
p-Terphenyl-d14 (surr.)	1	%	87	127	99	94
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	-	-	-
4.4'-DDD	0.05	mg/kg	< 0.05	-	-	-
4.4'-DDE	0.05	mg/kg	< 0.05	-	-	-
4.4'-DDT	0.05	mg/kg	< 0.05	-	-	-
a-BHC	0.05	mg/kg	< 0.05	-	-	-
Aldrin	0.05	mg/kg	< 0.05	-	-	-
b-BHC	0.05	mg/kg	< 0.05	-	-	-
d-BHC	0.05	mg/kg	< 0.05	-	-	-
Dieldrin	0.05	mg/kg	< 0.05	-	-	-
Endosulfan I	0.05	mg/kg	< 0.05	-	-	-

Client Sample ID			TP39-0.0-0.1	TP40-0.0-0.1	SP01-TP01-0.8-0.9	SP02-TP02-3.4-3.5
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S18-Fe02479**	**S18-Fe02480**	**S18-Fe02481**	**S18-Fe02482**
Date Sampled			**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Endosulfan II	0.05	mg/kg	< 0.05	-	-	-
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	-	-
Endrin	0.05	mg/kg	< 0.05	-	-	-
Endrin aldehyde	0.05	mg/kg	< 0.05	-	-	-
Endrin ketone	0.05	mg/kg	< 0.05	-	-	-
g-BHC (Lindane)	0.05	mg/kg	< 0.05	-	-	-
Heptachlor	0.05	mg/kg	< 0.05	-	-	-
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	-	-
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	-	-
Methoxychlor	0.05	mg/kg	< 0.05	-	-	-
Toxaphene	1	mg/kg	< 1	-	-	-
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	-	-	-
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	-	-	-
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	-	-	-
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	-	-	-
Dibutylchlorendate (surr.)	1	%	84	-	-	-
Tetrachloro-m-xylene (surr.)	1	%	95	-	-	-
Polychlorinated Biphenyls						
Aroclor-1016	0.1	mg/kg	< 0.1	-	-	-
Aroclor-1221	0.1	mg/kg	< 0.1	-	-	-
Aroclor-1232	0.1	mg/kg	< 0.1	-	-	-
Aroclor-1242	0.1	mg/kg	< 0.1	-	-	-
Aroclor-1248	0.1	mg/kg	< 0.1	-	-	-
Aroclor-1254	0.1	mg/kg	< 0.1	-	-	-
Aroclor-1260	0.1	mg/kg	< 0.1	-	-	-
Total PCB*	0.1	mg/kg	< 0.1	-	-	-
Dibutylchlorendate (surr.)	1	%	84	-	-	-
Tetrachloro-m-xylene (surr.)	1	%	95	-	-	-
Heavy Metals						
Arsenic	2	mg/kg	6.4	13	14	3.2
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	53	72	48	8.4
Copper	5	mg/kg	21	8.7	7.7	8.2
Lead	5	mg/kg	22	31	16	8.7
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	32	6.3	< 5	< 5
Zinc	5	mg/kg	74	23	7.4	11
% Moisture	1	%	5.8	6.0	9.2	10

Client Sample ID			SP02-TP03-0.9-1.0	FTSP01	FTSP03	QA20180201-01
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S18-Fe02483**	**S18-Fe02484**	**S18-Fe02485**	**S18-Fe02490**
Date Sampled			**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**	**Feb 01, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	-	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	-	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	-	< 50
TRH C29-C36	50	mg/kg	< 50	67	-	< 50
TRH C10-36 (Total)	50	mg/kg	< 50	67	-	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	-	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	-	< 0.3
4-Bromofluorobenzene (surr.)	1	%	107	108	-	109
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	-	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	-	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	-	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	-	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	-	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	-	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	0.6	0.6	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	1.2	1.2	1.2
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Chrysene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5	0.7	< 0.5	< 0.5
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Pyrene	0.5	mg/kg	< 0.5	0.7	< 0.5	< 0.5
Total PAH*	0.5	mg/kg	< 0.5	1.4	< 0.5	< 0.5
2-Fluorobiphenyl (surr.)	1	%	82	84	103	95
p-Terphenyl-d14 (surr.)	1	%	98	95	117	107

Client Sample ID			SP02-TP03-0.9-1.0	FTSP01	FTSP03	QA20180201-01
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02483	S18-Fe02484	S18-Fe02485	S18-Fe02490
Date Sampled			Feb 01, 2018	Feb 01, 2018	Feb 01, 2018	Feb 01, 2018
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	-	-	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05	-	-	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05	-	-	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05	-	-	< 0.05
a-BHC	0.05	mg/kg	< 0.05	-	-	< 0.05
Aldrin	0.05	mg/kg	< 0.05	-	-	< 0.05
b-BHC	0.05	mg/kg	< 0.05	-	-	< 0.05
d-BHC	0.05	mg/kg	< 0.05	-	-	< 0.05
Dieldrin	0.05	mg/kg	< 0.05	-	-	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05	-	-	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05	-	-	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	-	< 0.05
Endrin	0.05	mg/kg	< 0.05	-	-	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05	-	-	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05	-	-	< 0.05
g-BHC (Lindane)	0.05	mg/kg	< 0.05	-	-	< 0.05
Heptachlor	0.05	mg/kg	< 0.05	-	-	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	-	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	-	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05	-	-	< 0.05
Toxaphene	1	mg/kg	< 1	-	-	< 1
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	-	-	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	-	-	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	-	-	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	-	-	< 0.1
Dibutylchlorendate (surr.)	1	%	101	-	-	73
Tetrachloro-m-xylene (surr.)	1	%	97	-	-	83
Polychlorinated Biphenyls						
Aroclor-1016	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1221	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1232	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1242	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1248	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1254	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1260	0.1	mg/kg	< 0.1	-	-	< 0.1
Total PCB*	0.1	mg/kg	< 0.1	-	-	< 0.1
Dibutylchlorendate (surr.)	1	%	101	-	-	73
Tetrachloro-m-xylene (surr.)	1	%	97	-	-	83
Heavy Metals						
Arsenic	2	mg/kg	4.8	10	5.1	7.5
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	11	85	23	17
Copper	5	mg/kg	17	31	14	30
Lead	5	mg/kg	14	63	35	49
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	9.5	38	< 5	14
Zinc	5	mg/kg	32	170	65	210
% Moisture	1	%	7.7	8.5	7.1	2.5

Client Sample ID			TP38-0.0-0.1
Sample Matrix			Soil
Eurofins | mgt Sample No.			S18-Fe02759
Date Sampled			Feb 01, 2018
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons			
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2
Acenaphthene	0.5	mg/kg	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5
Anthracene	0.5	mg/kg	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5
Chrysene	0.5	mg/kg	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5
Fluorene	0.5	mg/kg	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5
Naphthalene	0.5	mg/kg	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5
Pyrene	0.5	mg/kg	0.5
Total PAH*	0.5	mg/kg	0.5
2-Fluorobiphenyl (surr.)	1	%	91
p-Terphenyl-d14 (surr.)	1	%	104
Heavy Metals			
Arsenic	2	mg/kg	6.7
Cadmium	0.4	mg/kg	< 0.4
Chromium	5	mg/kg	25
Copper	5	mg/kg	14
Lead	5	mg/kg	40
Mercury	0.1	mg/kg	< 0.1
Nickel	5	mg/kg	7.6
Zinc	5	mg/kg	58
% Moisture	1	%	5.9

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Feb 07, 2018	14 Day
- Method: LTM-ORG-2010 TRH C6-C36			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Feb 07, 2018	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Feb 07, 2018	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
BTEX	Melbourne	Feb 07, 2018	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Polycyclic Aromatic Hydrocarbons	Melbourne	Feb 07, 2018	14 Day
- Method: LTM-ORG-2130 PAH and Phenols in Soils by GCMS			
Organochlorine Pesticides	Melbourne	Feb 07, 2018	14 Day
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water			
Polychlorinated Biphenyls	Melbourne	Feb 07, 2018	28 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water			
Metals M8	Melbourne	Feb 07, 2018	28 Days
- Method: LTM-MET-3030 by ICP-OES (hydride ICP-OES for Mercury)			
% Moisture	Melbourne	Feb 02, 2018	14 Day
- Method: LTM-GEN-7080 Moisture			

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ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: ST MARYS PSI
Project ID: 54340

Order No.:
Report #: 582994
Phone: 02 8245 0300
Fax:

Received: Feb 2, 2018 3:23 PM
Due: Feb 9, 2018
Priority: 5 Day
Contact Name: Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
External Laboratory																
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**											
1	TP23-0-0.1	Feb 01, 2018		Soil	S18-Fe02463	X				X	X	X	X	X	X	X
2	TP24-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02464	X				X			X	X	X	X
3	TP25-0-0.1	Feb 01, 2018		Soil	S18-Fe02465	X				X			X		X	
4	TP26-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02466	X				X			X	X	X	X
5	TP27-0-0.1	Feb 01, 2018		Soil	S18-Fe02467	X				X			X	X	X	X
6	TP28-0-0.1	Feb 01, 2018		Soil	S18-Fe02468	X				X			X		X	
7	TP29-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02469	X				X			X		X	
8	TP30-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02470	X				X	X	X	X	X	X	X
9	TP31-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02471	X				X			X	X	X	X

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

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ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Feb 2, 2018 3:23 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	582994	**Due:**	Feb 9, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Katie Linz
Project Name:	ST MARYS PSI				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
10	TP32-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02472	X				X			X		X	
11	TP33-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02473	X				X			X		X	
12	TP34-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02474	X				X	X	X	X	X	X	X
13	TP35-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02475	X				X			X		X	
14	TP36-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02476	X				X			X		X	
15	TP37-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02477	X				X			X	X	X	X
16	TP37-0.9-1.0	Feb 01, 2018		Soil	S18-Fe02478	X				X			X		X	
17	TP39-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02479	X				X	X	X	X	X	X	X
18	TP40-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02480	X				X			X		X	
19	SP01-TP01-0.8-0.9	Feb 01, 2018		Soil	S18-Fe02481	X				X			X		X	
20	SP02-TP02-3.4-3.5	Feb 01, 2018		Soil	S18-Fe02482	X				X			X	X	X	X

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web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
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Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Feb 2, 2018 3:23 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	582994	**Due:**	Feb 9, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Katie Linz
Project Name:	ST MARYS PSI				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
21	SP02-TP03-0.9-1.0	Feb 01, 2018		Soil	S18-Fe02483	X				X	X	X	X	X	X	X
22	FTSP01	Feb 01, 2018		Soil	S18-Fe02484	X				X			X	X	X	X
23	FTSP03	Feb 01, 2018		Soil	S18-Fe02485	X				X			X		X	
24	FTSP03-ACM	Feb 01, 2018		Building Materials	S18-Fe02486		X									
25	ACMSP-01	Feb 01, 2018		Building Materials	S18-Fe02487		X									
26	ACMSP-02	Feb 01, 2018		Building Materials	S18-Fe02488		X									
27	ACMSP-03	Feb 01, 2018		Building Materials	S18-Fe02489		X									
28	QA20180201-01	Feb 01, 2018		Soil	S18-Fe02490	X				X	X	X	X	X	X	X

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Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

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Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
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Kewdale WA 6105
Phone : +61 8 9251 9600
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Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:** **Phone:** **Fax:**	582994 02 8245 0300	**Due:** **Priority:** **Contact Name:**	Feb 9, 2018 5 Day Katie Linz
Project Name:	ST MARYS PSI				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
29	TP23-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02491			X								
30	TP24-0-0.1	Feb 01, 2018		Soil	S18-Fe02492			X								
31	TP24-0.4-0.5	Feb 01, 2018		Soil	S18-Fe02493			X								
32	TP25-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02494			X								
33	TP26-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02495			X								
34	TP26-0.9-1.0	Feb 01, 2018		Soil	S18-Fe02496			X								
35	TP26-1.4-1.5	Feb 01, 2018		Soil	S18-Fe02497			X								
36	TP27-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02498			X								
37	TP27-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02499			X								
38	TP27-0.9-1.0	Feb 01, 2018		Soil	S18-Fe02500			X								
39	TP28-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02501			X								
40	TP28-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02502			X								

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web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
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NATA # 1261 Site # 20794

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2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

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Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: ST MARYS PSI
Project ID: 54340

Order No.:
Report #: 582994
Phone: 02 8245 0300
Fax:

Received: Feb 2, 2018 3:23 PM
Due: Feb 9, 2018
Priority: 5 Day
Contact Name: Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
41	TP29-0-0.1	Feb 01, 2018		Soil	S18-Fe02503			X								
42	TP29-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02504			X								
43	TP30-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02505			X								
44	TP30-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02506			X								
45	TP31-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02507			X								
46	TP31-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02508			X								
47	TP32-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02509			X								
48	TP32-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02510			X								
49	TP33-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02511			X								
50	TP34-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02512			X								
51	TP35-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02513			X								
52	TP35-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02514			X								

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web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
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Lane Cove West NSW 2066
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		Fax:		**Contact Name:**	Katie Linz
Project Name:	ST MARYS PSI				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
53	TP36-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02515			X								
54	TP36-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02516			X								
55	TP37-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02517			X								
56	TP37-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02518			X								
57	TP38-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02520			X								
58	TP38-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02521			X								
59	TP38-0.9-1.0	Feb 01, 2018		Soil	S18-Fe02522			X								
60	TP39-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02523			X								
61	TP40-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02524			X								
62	SP01-TP02-0.7-0.8	Feb 01, 2018		Soil	S18-Fe02525			X								
63	SP02-TP01-0.9-1.0	Feb 01, 2018		Soil	S18-Fe02526			X								

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web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

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2/91 Leach Highway
Kewdale WA 6105
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NATA # 1261
Site # 23736

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Sydney
NSW 2000

Project Name: ST MARYS PSI
Project ID: 54340

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Priority: 5 Day
Contact Name: Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
64	SP02-TP03-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02527			X								
65	SP02-TP03-4.5-4.6	Feb 01, 2018		Soil	S18-Fe02528			X								
66	ETSP02	Feb 01, 2018		Soil	S18-Fe02529			X								
67	TP26-0-0.1	Feb 01, 2018		Soil	S18-Fe02758			X								
68	TP38-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02759	X				X			X		X	
69	TP14-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02815			X								
70	TP14-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02816			X								
71	TP14-0.5-0.6	Feb 02, 2018		Soil	S18-Fe02817			X								
72	TP15-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02818			X								
73	TP15-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02819			X								
74	TP16-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02820			X								

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Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

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Project Name:	ST MARYS PSI				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
75	TP16-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02821			X								
76	TP17-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02822			X								
77	TP17-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02823			X								
78	TP18-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02824			X								
79	TP18-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02825			X								
80	TP19-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02826			X								
81	TP19-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02827			X								
82	TP20-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02828			X								
83	TP20-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02829			X								
84	TP21-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02830			X								
85	TP21-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02831			X								
86	TP22-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02832			X								

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Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
87	TP22-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02833			X								
88	FTSP04	Feb 02, 2018		Soil	S18-Fe02834			X								
89	FTSP06	Feb 02, 2018		Soil	S18-Fe02835			X								
90	FTSP07	Feb 02, 2018		Soil	S18-Fe02836			X								
91	DS01	Feb 02, 2018		Soil	S18-Fe02837			X								
92	QA20180201-01	Feb 02, 2018		Soil	S18-Fe02838			X								
93	QA20180202-01	Feb 02, 2018		Soil	S18-Fe02839			X								
94	TP19-0.0-0.1 ACM	Feb 01, 2018		Building Materials	S18-Fe03620				X							
95	QA20180201-02	Feb 01, 2018		Soil	S18-Fe05686				X							

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Sample Detail	Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271			X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217	X	X		X							
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
Test Counts	25	4	66	66	25	6	6	25	13	25	13

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Organochlorine Pesticides							
Chlordanes - Total	mg/kg	< 0.1			0.1	Pass	
4.4'-DDD	mg/kg	< 0.05			0.05	Pass	
4.4'-DDE	mg/kg	< 0.05			0.05	Pass	
4.4'-DDT	mg/kg	< 0.05			0.05	Pass	
a-BHC	mg/kg	< 0.05			0.05	Pass	
Aldrin	mg/kg	< 0.05			0.05	Pass	
b-BHC	mg/kg	< 0.05			0.05	Pass	
d-BHC	mg/kg	< 0.05			0.05	Pass	
Dieldrin	mg/kg	< 0.05			0.05	Pass	
Endosulfan I	mg/kg	< 0.05			0.05	Pass	
Endosulfan II	mg/kg	< 0.05			0.05	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endosulfan sulphate	mg/kg	< 0.05			0.05	Pass	
Endrin	mg/kg	< 0.05			0.05	Pass	
Endrin aldehyde	mg/kg	< 0.05			0.05	Pass	
Endrin ketone	mg/kg	< 0.05			0.05	Pass	
g-BHC (Lindane)	mg/kg	< 0.05			0.05	Pass	
Heptachlor	mg/kg	< 0.05			0.05	Pass	
Heptachlor epoxide	mg/kg	< 0.05			0.05	Pass	
Hexachlorobenzene	mg/kg	< 0.05			0.05	Pass	
Methoxychlor	mg/kg	< 0.05			0.05	Pass	
Toxaphene	mg/kg	< 1			1	Pass	
Method Blank							
Polychlorinated Biphenyls							
Aroclor-1016	mg/kg	< 0.1			0.1	Pass	
Aroclor-1221	mg/kg	< 0.1			0.1	Pass	
Aroclor-1232	mg/kg	< 0.1			0.1	Pass	
Aroclor-1242	mg/kg	< 0.1			0.1	Pass	
Aroclor-1248	mg/kg	< 0.1			0.1	Pass	
Aroclor-1254	mg/kg	< 0.1			0.1	Pass	
Aroclor-1260	mg/kg	< 0.1			0.1	Pass	
Total PCB*	mg/kg	< 0.1			0.1	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	89			70-130	Pass	
TRH C10-C14	%	88			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	76			70-130	Pass	
Toluene	%	85			70-130	Pass	
Ethylbenzene	%	94			70-130	Pass	
m&p-Xylenes	%	94			70-130	Pass	
Xylenes - Total	%	94			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	77			70-130	Pass	
TRH C6-C10	%	84			70-130	Pass	
TRH >C10-C16	%	87			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	100			70-130	Pass	
Acenaphthylene	%	105			70-130	Pass	
Anthracene	%	103			70-130	Pass	
Benz(a)anthracene	%	85			70-130	Pass	
Benzo(a)pyrene	%	106			70-130	Pass	
Benzo(b&j)fluoranthene	%	77			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzo(g.h.i)perylene	%	88			70-130	Pass	
Benzo(k)fluoranthene	%	121			70-130	Pass	
Chrysene	%	106			70-130	Pass	
Dibenz(a.h)anthracene	%	80			70-130	Pass	
Fluoranthene	%	104			70-130	Pass	
Fluorene	%	103			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	72			70-130	Pass	
Naphthalene	%	100			70-130	Pass	
Phenanthrene	%	99			70-130	Pass	
Pyrene	%	104			70-130	Pass	
LCS - % Recovery							
Organochlorine Pesticides							
4.4'-DDD	%	101			70-130	Pass	
4.4'-DDE	%	102			70-130	Pass	
4.4'-DDT	%	83			70-130	Pass	
a-BHC	%	98			70-130	Pass	
Aldrin	%	104			70-130	Pass	
b-BHC	%	86			70-130	Pass	
d-BHC	%	90			70-130	Pass	
Dieldrin	%	100			70-130	Pass	
Endosulfan I	%	98			70-130	Pass	
Endosulfan II	%	95			70-130	Pass	
Endosulfan sulphate	%	96			70-130	Pass	
Endrin	%	86			70-130	Pass	
Endrin aldehyde	%	93			70-130	Pass	
Endrin ketone	%	93			70-130	Pass	
g-BHC (Lindane)	%	96			70-130	Pass	
Heptachlor	%	100			70-130	Pass	
Heptachlor epoxide	%	103			70-130	Pass	
Hexachlorobenzene	%	95			70-130	Pass	
Methoxychlor	%	74			70-130	Pass	
LCS - % Recovery							
Polychlorinated Biphenyls							
Aroclor-1260	%	95			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	93			80-120	Pass	
Cadmium	%	91			80-120	Pass	
Chromium	%	97			80-120	Pass	
Copper	%	89			80-120	Pass	
Lead	%	96			80-120	Pass	
Mercury	%	103			75-125	Pass	
Nickel	%	92			80-120	Pass	
Zinc	%	91			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M18-Fe08546	NCP	%	72			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M18-Fe08546	NCP	%	73			70-130	Pass	
Spike - % Recovery									
Polychlorinated Biphenyls				Result 1					
Aroclor-1260	M18-Fe04723	NCP	%	104			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	S18-Fe02466	CP	%	91			70-130	Pass	
Acenaphthylene	S18-Fe02466	CP	%	101			70-130	Pass	
Anthracene	S18-Fe02466	CP	%	102			70-130	Pass	
Benz(a)anthracene	S18-Fe02466	CP	%	109			70-130	Pass	
Benzo(a)pyrene	S18-Fe02466	CP	%	86			70-130	Pass	
Benzo(b&j)fluoranthene	S18-Fe02466	CP	%	88			70-130	Pass	
Benzo(g.h.i)perylene	S18-Fe02466	CP	%	74			70-130	Pass	
Benzo(k)fluoranthene	S18-Fe02466	CP	%	70			70-130	Pass	
Chrysene	S18-Fe02466	CP	%	99			70-130	Pass	
Dibenz(a.h)anthracene	S18-Fe02466	CP	%	81			70-130	Pass	
Fluoranthene	S18-Fe02466	CP	%	91			70-130	Pass	
Fluorene	S18-Fe02466	CP	%	95			70-130	Pass	
Indeno(1.2.3-cd)pyrene	S18-Fe02466	CP	%	79			70-130	Pass	
Naphthalene	S18-Fe02466	CP	%	88			70-130	Pass	
Phenanthrene	S18-Fe02466	CP	%	95			70-130	Pass	
Pyrene	S18-Fe02466	CP	%	89			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S18-Fe02468	CP	%	93			75-125	Pass	
Cadmium	S18-Fe02468	CP	%	89			75-125	Pass	
Chromium	S18-Fe02468	CP	%	65			75-125	Fail	Q08
Copper	S18-Fe02468	CP	%	133			75-125	Fail	Q08
Lead	S18-Fe02468	CP	%	117			75-125	Pass	
Mercury	S18-Fe02468	CP	%	91			70-130	Pass	
Nickel	S18-Fe02468	CP	%	57			75-125	Fail	Q08
Zinc	S18-Fe02468	CP	%	95			75-125	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	S18-Fe02476	CP	%	89			70-130	Pass	
Acenaphthylene	S18-Fe02476	CP	%	99			70-130	Pass	
Anthracene	S18-Fe02476	CP	%	96			70-130	Pass	
Benz(a)anthracene	S18-Fe02476	CP	%	91			70-130	Pass	
Benzo(a)pyrene	S18-Fe02476	CP	%	94			70-130	Pass	
Benzo(b&j)fluoranthene	S18-Fe02476	CP	%	84			70-130	Pass	
Benzo(g.h.i)perylene	S18-Fe02476	CP	%	77			70-130	Pass	
Benzo(k)fluoranthene	S18-Fe02476	CP	%	92			70-130	Pass	
Chrysene	S18-Fe02476	CP	%	86			70-130	Pass	
Dibenz(a.h)anthracene	S18-Fe02476	CP	%	84			70-130	Pass	
Fluoranthene	S18-Fe02476	CP	%	80			70-130	Pass	
Fluorene	S18-Fe02476	CP	%	94			70-130	Pass	
Indeno(1.2.3-cd)pyrene	S18-Fe02476	CP	%	86			70-130	Pass	
Naphthalene	S18-Fe02476	CP	%	90			70-130	Pass	
Phenanthrene	S18-Fe02476	CP	%	119			70-130	Pass	
Pyrene	S18-Fe02476	CP	%	78			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	S18-Fe02477	CP	%	101			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	S18-Fe02477	CP	%	79			70-130	Pass	
Toluene	S18-Fe02477	CP	%	91			70-130	Pass	
Ethylbenzene	S18-Fe02477	CP	%	104			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
m&p-Xylenes	S18-Fe02477	CP	%	106			70-130	Pass	
o-Xylene	S18-Fe02477	CP	%	104			70-130	Pass	
Xylenes - Total	S18-Fe02477	CP	%	105			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	S18-Fe02477	CP	%	84			70-130	Pass	
TRH C6-C10	S18-Fe02477	CP	%	97			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S18-Fe02478	CP	%	85			75-125	Pass	
Cadmium	S18-Fe02478	CP	%	85			75-125	Pass	
Chromium	S18-Fe02478	CP	%	90			75-125	Pass	
Copper	S18-Fe02478	CP	%	88			75-125	Pass	
Lead	S18-Fe02478	CP	%	84			75-125	Pass	
Mercury	S18-Fe02478	CP	%	92			70-130	Pass	
Nickel	S18-Fe02478	CP	%	79			75-125	Pass	
Zinc	S18-Fe02478	CP	%	84			75-125	Pass	
Spike - % Recovery									
Organochlorine Pesticides				Result 1					
4.4'-DDD	S18-Fe02490	CP	%	99			70-130	Pass	
4.4'-DDE	S18-Fe02490	CP	%	90			70-130	Pass	
4.4'-DDT	S18-Fe02490	CP	%	95			70-130	Pass	
a-BHC	S18-Fe02490	CP	%	94			70-130	Pass	
Aldrin	S18-Fe02490	CP	%	96			70-130	Pass	
b-BHC	S18-Fe02490	CP	%	81			70-130	Pass	
d-BHC	S18-Fe02490	CP	%	85			70-130	Pass	
Dieldrin	S18-Fe02490	CP	%	91			70-130	Pass	
Endosulfan I	S18-Fe02490	CP	%	90			70-130	Pass	
Endosulfan II	S18-Fe02490	CP	%	88			70-130	Pass	
Endosulfan sulphate	S18-Fe02490	CP	%	96			70-130	Pass	
Endrin	S18-Fe02490	CP	%	76			70-130	Pass	
Endrin aldehyde	S18-Fe02490	CP	%	80			70-130	Pass	
Endrin ketone	S18-Fe02490	CP	%	82			70-130	Pass	
g-BHC (Lindane)	S18-Fe02490	CP	%	88			70-130	Pass	
Heptachlor	S18-Fe02490	CP	%	87			70-130	Pass	
Heptachlor epoxide	S18-Fe02490	CP	%	92			70-130	Pass	
Hexachlorobenzene	S18-Fe02490	CP	%	91			70-130	Pass	
Methoxychlor	S18-Fe02490	CP	%	87			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	M18-Fe08545	NCP	mg/kg	84	57	39	30%	Fail	Q15
TRH C15-C28	M18-Fe08545	NCP	mg/kg	98	72	31	30%	Fail	Q15
TRH C29-C36	M18-Fe08545	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	M18-Fe08545	NCP	mg/kg	130	97	29	30%	Pass	
TRH >C16-C34	M18-Fe08545	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	M18-Fe08545	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M18-Fe06069	NCP	%	2.9	2.7	7.0	30%	Pass	

Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S18-Fe02467	CP	mg/kg	9.8	11	8.0	30%	Pass	
Cadmium	S18-Fe02467	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	S18-Fe02467	CP	mg/kg	25	24	3.0	30%	Pass	
Copper	S18-Fe02467	CP	mg/kg	17	16	3.0	30%	Pass	
Lead	S18-Fe02467	CP	mg/kg	41	39	4.0	30%	Pass	
Mercury	S18-Fe02467	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	S18-Fe02467	CP	mg/kg	5.6	5.3	4.0	30%	Pass	
Zinc	S18-Fe02467	CP	mg/kg	38	37	1.0	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S18-Fe02468	CP	mg/kg	6.6	6.0	9.0	30%	Pass	
Cadmium	S18-Fe02468	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	S18-Fe02468	CP	mg/kg	30	31	1.0	30%	Pass	
Copper	S18-Fe02468	CP	mg/kg	59	60	2.0	30%	Pass	
Lead	S18-Fe02468	CP	mg/kg	79	81	2.0	30%	Pass	
Mercury	S18-Fe02468	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	S18-Fe02468	CP	mg/kg	30	30	<1	30%	Pass	
Zinc	S18-Fe02468	CP	mg/kg	62	64	4.0	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	S18-Fe02474	CP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	S18-Fe02474	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	S18-Fe02474	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	S18-Fe02474	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	S18-Fe02474	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	S18-Fe02474	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	S18-Fe02474	CP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	S18-Fe02474	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	S18-Fe02474	CP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	S18-Fe02475	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	

Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S18-Fe02477	CP	mg/kg	6.6	7.4	12	30%	Pass	
Cadmium	S18-Fe02477	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chromium	S18-Fe02477	CP	mg/kg	21	22	8.0	30%	Pass	
Copper	S18-Fe02477	CP	mg/kg	22	16	32	30%	Fail	Q15
Lead	S18-Fe02477	CP	mg/kg	21	19	8.0	30%	Pass	
Mercury	S18-Fe02477	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	S18-Fe02477	CP	mg/kg	12	12	7.0	30%	Pass	
Zinc	S18-Fe02477	CP	mg/kg	83	82	1.0	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S18-Fe02478	CP	mg/kg	7.0	6.2	13	30%	Pass	
Cadmium	S18-Fe02478	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	S18-Fe02478	CP	mg/kg	21	21	1.0	30%	Pass	
Lead	S18-Fe02478	CP	mg/kg	12	12	3.0	30%	Pass	
Mercury	S18-Fe02478	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	S18-Fe02478	CP	mg/kg	< 5	< 5	<1	30%	Pass	
Zinc	S18-Fe02478	CP	mg/kg	9.8	9.6	2.0	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	S18-Fe02483	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Chlordanes - Total	S18-Fe02483	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
4.4'-DDD	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDE	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDT	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-BHC	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Aldrin	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-BHC	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-BHC	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin aldehyde	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-BHC (Lindane)	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	

Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Heptachlor epoxide	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	S18-Fe02483	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Toxaphene	S18-Fe02483	CP	mg/kg	< 1	< 1	<1	30%	Pass	
Duplicate									
Polychlorinated Biphenyls				Result 1	Result 2	RPD			
Aroclor-1016	S18-Fe02483	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1221	S18-Fe02483	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1232	S18-Fe02483	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1242	S18-Fe02483	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1248	S18-Fe02483	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1254	S18-Fe02483	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1260	S18-Fe02483	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Total PCB*	S18-Fe02483	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference
Q15	The RPD reported passes Eurofins | mgt's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised By

Nibha Vaidya	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Harry Bacalis	Senior Analyst-Volatile (VIC)
Huong Le	Senior Analyst-Inorganic (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Nibha Vaidya	Senior Analyst-Asbestos (NSW)



Glenn Jackson

National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Certificate of Analysis

Accredited for compliance with ISO/IEC 17025–Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention:	Katie Linz
Report	582994-AID
Project Name	ST MARYS PSI
Project ID	54340
Received Date	Feb 02, 2018
Date Reported	Feb 09, 2018

Methodology:

Asbestos Fibre Identification	Conducted in accordance with the Australian Standard AS 4964 – 2004: Method for the Qualitative Identification of Asbestos in Bulk Samples and in-house Method LTM-ASB-8020 by polarised light microscopy (PLM) and dispersion staining (DS) techniques. *NOTE: Positive Trace Analysis results indicate the sample contains detectable respirable fibres.*
Unknown Mineral Fibres	Mineral fibres of unknown type, as determined by PLM with DS, may require another analytical technique, such as Electron Microscopy, to confirm unequivocal identity. *NOTE: While Actinolite, Anthophyllite and Tremolite asbestos may be detected by PLM with DS, due to variability in the optical properties of these materials, AS4964 requires that these are reported as UMF unless confirmed by an independent technique.*
Subsampling Soil Samples	The whole sample submitted is first dried and then passed through a 10mm sieve followed by a 2mm sieve. All fibrous matter greater than 10mm, greater than 2mm as well as the material passing through the 2mm sieve are retained and analysed for the presence of asbestos. If the sub 2mm fraction is greater than approximately 30 to 60g then a sub-sampling routine based on ISO 3082:2009(E) is employed. *NOTE: Depending on the nature and size of the soil sample, the sub-2 mm residue material may need to be sub-sampled for trace analysis, in accordance with AS 4964-2004.*
Bonded asbestos-containing material (ACM)	The material is first examined and any fibres isolated for identification by PLM and DS. Where required, interfering matrices may be removed by disintegration using a range of heat, chemical or physical treatments, possibly in combination.The resultant material is then further examined in accordance with AS 4964 - 2004. *NOTE: Even after disintegration it may be difficult to detect the presence of asbestos in some asbestos-containing bulk materials using PLM and DS. This is due to the low grade or small length or diameter of the asbestos fibres present in the material, or to the fact that very fine fibres have been distributed intimately throughout the materials. Vinyl/asbestos floor tiles, some asbestos-containing sealants and mastics, asbestos-containing epoxy resins and some ore samples are examples of these types of material, which are difficult to analyse.*
Limit of Reporting	The performance limitation of the AS4964 method for inhomogeneous samples is around 0.1 g/kg (0.01% (w/w)). Where no asbestos is found by PLM and DS, including Trace Analysis where required, this is considered to be at the nominal reporting limit of 0.01 % (w / w).The examination of large sample sizes(500 mL is recommended) may improve the likelihood of identifying ACM in the > 2mm fraction.The NEPM screening level of 0.001 % (w / w) asbestos in soil for FA(friable asbestos) and AF(asbestos fines) then applies where they are able to be quantified by gravimetric procedures.This quantitative screening is not generally applicable to FF(free fibres) and results of Trace Analysis are referred. *NOTE: NATA News March 2014, p.7, states in relation to AS4964: "This is a qualitative method with a nominal reporting limit of 0.01%" and that currently in Australia "there is no validated method available for the quantification of asbestos". Accordingly, NATA Accreditation does not cover the performance of this service (indicated with an asterisk).* *This report is consistent with the analytical procedures and reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, 2013 (as amended) and the Western Australia Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia, 2009, including supporting document Recommended Procedures for Laboratory Analysis of Asbestos in Soil, June 2011.*

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Project Name ST MARYS PSI
Project ID 54340
Date Sampled Feb 01, 2018
Report 582994-AID

Client Sample ID	Eurofins | mgt Sample No.	Date Sampled	Sample Description	Result
TP23-0-0.1	18-Fe02463	Feb 01, 2018	Approximate Sample 756g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP24-0.2-0.3	18-Fe02464	Feb 01, 2018	Approximate Sample 823g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP25-0-0.1	18-Fe02465	Feb 01, 2018	Approximate Sample 632g Sample consisted of: Brown coarse grain soil, rocks and organic debris	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP26-0.2-0.3	18-Fe02466	Feb 01, 2018	Approximate Sample 1133g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP27-0-0.1	18-Fe02467	Feb 01, 2018	Approximate Sample 739g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP28-0-0.1	18-Fe02468	Feb 01, 2018	Approximate Sample 1042g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP29-0.2-0.3	18-Fe02469	Feb 01, 2018	Approximate Sample 759g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP30-0.0-0.1	18-Fe02470	Feb 01, 2018	Approximate Sample 954g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP31-0.2-0.3	18-Fe02471	Feb 01, 2018	Approximate Sample 989g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP32-0.2-0.3	18-Fe02472	Feb 01, 2018	Approximate Sample 1021g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.

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Version: 1, Version Date: 26/11/2018

Client Sample ID	Eurofins | mgt Sample No.	Date Sampled	Sample Description	Result
TP33-0.2-0.3	18-Fe02473	Feb 01, 2018	Approximate Sample 724g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP34-0.0-0.1	18-Fe02474	Feb 01, 2018	Approximate Sample 601g Sample consisted of: Brown coarse grain soil, rocks and debris	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP35-0.0-0.1	18-Fe02475	Feb 01, 2018	Approximate Sample 820g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP36-0.2-0.3	18-Fe02476	Feb 01, 2018	Approximate Sample 1019g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP37-0.2-0.3	18-Fe02477	Feb 01, 2018	Approximate Sample 870g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP37-0.9-1.0	18-Fe02478	Feb 01, 2018	Approximate Sample 568g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP39-0.0-0.1	18-Fe02479	Feb 01, 2018	Approximate Sample 795g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP40-0.0-0.1	18-Fe02480	Feb 01, 2018	Approximate Sample 953g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
SP01-TP01-0.8-0.9	18-Fe02481	Feb 01, 2018	Approximate Sample 808g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
SP02-TP02-3.4-3.5	18-Fe02482	Feb 01, 2018	Approximate Sample 716g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
SP02-TP03-0.9-1.0	18-Fe02483	Feb 01, 2018	Approximate Sample 896g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
FTSP01	18-Fe02484	Feb 01, 2018	Approximate Sample 1008g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
FTSP03	18-Fe02485	Feb 01, 2018	Approximate Sample 767g Sample consisted of: Brown coarse grain soil, rocks and debris	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Client Sample ID	Eurofins | mgt Sample No.	Date Sampled	Sample Description	Result
FTSP03-ACM	18-Fe02486	Feb 01, 2018	Approximate Sample 81g / 108x94x3mm Sample consisted of: Grey fibre cement material	Chrysotile and amosite asbestos detected.
ACMSP-01	18-Fe02487	Feb 01, 2018	Approximate Sample 53g / 106x60x8mm Sample consisted of: Grey compressed fibre cement material	No asbestos detected. Organic fibre detected.
ACMSP-02	18-Fe02488	Feb 01, 2018	Approximate Sample 26g / 93x45x4mm Sample consisted of: Grey fibre cement material	Chrysotile and amosite asbestos detected.
ACMSP-03	18-Fe02489	Feb 01, 2018	Approximate Sample 11g / 48x56x4mm Sample consisted of: Grey fibre cement material	Chrysotile and amosite asbestos detected.
QA20180201-01	18-Fe02490	Feb 01, 2018	Approximate Sample 816g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP38-0.0-0.1	18-Fe02759	Feb 01, 2018	Approximate Sample 770g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Asbestos - LTM-ASB-8020	Sydney	Feb 09, 2018	Indefinite
Asbestos - LTM-ASB-8020	Sydney	Feb 09, 2018	Indefinite

eurofins | mgt

ABN – 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: ST MARYS PSI
Project ID: 54340

Order No.:
Report #: 582994
Phone: 02 8245 0300
Fax:

Received: Feb 2, 2018 3:23 PM
Due: Feb 9, 2018
Priority: 5 Day
Contact Name: Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
External Laboratory																
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**											
1	TP23-0-0.1	Feb 01, 2018		Soil	S18-Fe02463	X				X	X	X	X	X	X	X
2	TP24-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02464	X				X			X	X	X	X
3	TP25-0-0.1	Feb 01, 2018		Soil	S18-Fe02465	X				X			X		X	
4	TP26-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02466	X				X			X	X	X	X
5	TP27-0-0.1	Feb 01, 2018		Soil	S18-Fe02467	X				X			X	X	X	X
6	TP28-0-0.1	Feb 01, 2018		Soil	S18-Fe02468	X				X			X		X	
7	TP29-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02469	X				X			X		X	
8	TP30-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02470	X				X	X	X	X	X	X	X
9	TP31-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02471	X				X			X	X	X	X

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

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ABN – 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**	
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:** **Phone:** **Fax:**	582994 02 8245 0300
Project Name:	ST MARYS PSI		
Project ID:	54340		

Received:	Feb 2, 2018 3:23 PM
Due:	Feb 9, 2018
Priority:	5 Day
Contact Name:	Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
10	TP32-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02472	X				X			X		X	
11	TP33-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02473	X				X			X		X	
12	TP34-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02474	X				X	X	X	X	X	X	X
13	TP35-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02475	X				X			X		X	
14	TP36-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02476	X				X			X		X	
15	TP37-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02477	X				X			X	X	X	X
16	TP37-0.9-1.0	Feb 01, 2018		Soil	S18-Fe02478	X				X			X		X	
17	TP39-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02479	X				X	X	X	X	X	X	X
18	TP40-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02480	X				X			X		X	
19	SP01-TP01-0.8-0.9	Feb 01, 2018		Soil	S18-Fe02481	X				X			X		X	
20	SP02-TP02-3.4-3.5	Feb 01, 2018		Soil	S18-Fe02482	X				X			X	X	X	X

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ABN – 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
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Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**	
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:** **Phone:** **Fax:**	582994 02 8245 0300
Project Name:	ST MARYS PSI		
Project ID:	54340		

Received:	Feb 2, 2018 3:23 PM
Due:	Feb 9, 2018
Priority:	5 Day
Contact Name:	Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
21	SP02-TP03-0.9-1.0	Feb 01, 2018		Soil	S18-Fe02483	X				X	X	X	X	X	X	X
22	FTSP01	Feb 01, 2018		Soil	S18-Fe02484	X				X			X	X	X	X
23	FTSP03	Feb 01, 2018		Soil	S18-Fe02485	X				X			X		X	
24	FTSP03-ACM	Feb 01, 2018		Building Materials	S18-Fe02486		X									
25	ACMSP-01	Feb 01, 2018		Building Materials	S18-Fe02487		X									
26	ACMSP-02	Feb 01, 2018		Building Materials	S18-Fe02488		X									
27	ACMSP-03	Feb 01, 2018		Building Materials	S18-Fe02489		X									
28	QA20180201-01	Feb 01, 2018		Soil	S18-Fe02490	X				X	X	X	X	X	X	X

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Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
29	TP23-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02491			X								
30	TP24-0-0.1	Feb 01, 2018		Soil	S18-Fe02492			X								
31	TP24-0.4-0.5	Feb 01, 2018		Soil	S18-Fe02493			X								
32	TP25-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02494			X								
33	TP26-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02495			X								
34	TP26-0.9-1.0	Feb 01, 2018		Soil	S18-Fe02496			X								
35	TP26-1.4-1.5	Feb 01, 2018		Soil	S18-Fe02497			X								
36	TP27-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02498			X								
37	TP27-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02499			X								
38	TP27-0.9-1.0	Feb 01, 2018		Soil	S18-Fe02500			X								
39	TP28-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02501			X								
40	TP28-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02502			X								

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Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
41	TP29-0-0.1	Feb 01, 2018		Soil	S18-Fe02503			X								
42	TP29-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02504			X								
43	TP30-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02505			X								
44	TP30-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02506			X								
45	TP31-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02507			X								
46	TP31-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02508			X								
47	TP32-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02509			X								
48	TP32-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02510			X								
49	TP33-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02511			X								
50	TP34-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02512			X								
51	TP35-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02513			X								
52	TP35-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02514			X								

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Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
53	TP36-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02515			X								
54	TP36-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02516			X								
55	TP37-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02517			X								
56	TP37-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02518			X								
57	TP38-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02520			X								
58	TP38-0.5-0.6	Feb 01, 2018		Soil	S18-Fe02521			X								
59	TP38-0.9-1.0	Feb 01, 2018		Soil	S18-Fe02522			X								
60	TP39-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02523			X								
61	TP40-0.2-0.3	Feb 01, 2018		Soil	S18-Fe02524			X								
62	SP01-TP02-0.7-0.8	Feb 01, 2018		Soil	S18-Fe02525			X								
63	SP02-TP01-0.9-1.0	Feb 01, 2018		Soil	S18-Fe02526			X								

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Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
64	SP02-TP03-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02527			X								
65	SP02-TP03-4.5-4.6	Feb 01, 2018		Soil	S18-Fe02528			X								
66	ETSP02	Feb 01, 2018		Soil	S18-Fe02529			X								
67	TP26-0-0.1	Feb 01, 2018		Soil	S18-Fe02758			X								
68	TP38-0.0-0.1	Feb 01, 2018		Soil	S18-Fe02759	X				X			X		X	
69	TP14-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02815			X								
70	TP14-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02816			X								
71	TP14-0.5-0.6	Feb 02, 2018		Soil	S18-Fe02817			X								
72	TP15-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02818			X								
73	TP15-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02819			X								
74	TP16-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02820			X								

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ABN – 50 005 085 521
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web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
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Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
75	TP16-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02821			X								
76	TP17-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02822			X								
77	TP17-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02823			X								
78	TP18-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02824			X								
79	TP18-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02825			X								
80	TP19-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02826			X								
81	TP19-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02827			X								
82	TP20-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02828			X								
83	TP20-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02829			X								
84	TP21-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02830			X								
85	TP21-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02831			X								
86	TP22-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02832			X								

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Melbourne Laboratory - NATA Site # 1254 & 14271								X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X		X							
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
87	TP22-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02833			X								
88	FTSP04	Feb 02, 2018		Soil	S18-Fe02834			X								
89	FTSP06	Feb 02, 2018		Soil	S18-Fe02835			X								
90	FTSP07	Feb 02, 2018		Soil	S18-Fe02836			X								
91	DS01	Feb 02, 2018		Soil	S18-Fe02837			X								
92	QA20180201-01	Feb 02, 2018		Soil	S18-Fe02838			X								
93	QA20180202-01	Feb 02, 2018		Soil	S18-Fe02839			X								
94	TP19-0.0-0.1 ACM	Feb 01, 2018		Building Materials	S18-Fe03620				X							
95	QA20180201-02	Feb 01, 2018		Soil	S18-Fe05686				X							

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Sample Detail	Asbestos - WA guidelines	Asbestos Absence /Presence	HOLD	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271			X		X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217	X	X		X							
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
Test Counts	25	4	66	66	25	6	6	25	13	25	13

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Internal Quality Control Review and Glossary

General

1. QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Samples were analysed on an 'as received' basis.
4. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

Units

% w/w: weight for weight basis	grams per kilogram
Filter loading:	fibres/100 graticule areas
Reported Concentration:	fibres/mL
Flowrate:	L/min

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis
LOR	Limit of Reporting
COC	Chain of Custody
SRA	Sample Receipt Advice
ISO	International Standards Organisation
AS	Australian Standards
WA DOH	Western Australia Department of Health
NOHSC	National Occupational Health and Safety Commission
ACM	Bonded asbestos-containing material means any material containing more than 1% asbestos and comprises asbestos-containing-material which is in sound condition, although possibly broken or fragmented, and where the asbestos is bound in a matrix such as cement or resin. Common examples of ACM include but are not limited to: pipe and boiler insulation, sprayed-on fireproofing, troweled-on acoustical plaster, floor tile and mastic, floor linoleum, transite shingles, roofing materials, wall and ceiling plaster, ceiling tiles, and gasket materials. This term is restricted to material that cannot pass a 7 mm x 7 mm sieve. This sieve size is selected because it approximates the thickness of common asbestos cement sheeting and for fragments to be smaller than this would imply a high degree of damage and hence potential for fibre release.
FA	FA comprises friable asbestos material and includes severely weathered cement sheet, insulation products and woven asbestos material. This type of friable asbestos is defined here as asbestos material that is in a degraded condition such that it can be broken or crumbled by hand pressure. This material is typically unbonded or was previously bonded and is now significantly degraded (crumbling).
PACM	Presumed Asbestos-Containing Material means thermal system insulation and surfacing material found in buildings, vessels, and vessel sections constructed no later than 1980 that are assumed to contain greater than one percent asbestos but have not been sampled or analyzed to verify or negate the presence of asbestos.
AF	Asbestos fines (AF) are defined as free fibres, or fibre bundles, smaller than 7mm. It is the free fibres which present the greatest risk to human health, although very small fibres (< 5 microns in length) are not considered to be such a risk. AF also includes small fragments of bonded ACM that pass through a 7 mm x 7 mm sieve. (Note that for bonded ACM fragments to pass through a 7 mm x 7 mm sieve implies a substatntial degree of damage which increases the potential for fibre release.)
AC	Asbestos cement means a mixture of cement and asbestos fibres (typically 90:10 ratios).

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Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Qualifier Codes/Comments

Code	Description
N/A	Not applicable

Asbestos Counter/Identifier:

Laxman Dias	Senior Analyst-Asbestos (NSW)

Authorised by:

Sayeed Abu	Senior Analyst-Asbestos (NSW)



Glenn Jackson
National Operations Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

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Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

582904

1/4

018708

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: 54340
PROJECT NAME: St Marys PS1
DATE NEEDED BY: Std.
LABORATORY BATCH NO.:
SAMPLERS: Rob Sharp
QC LEVEL: NEPM (2013)
PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688
SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) KLim2@jbsg.com.au; (3) RSharp@jbsg.com.au
COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H. Metals	TRH	BTEX	PAHs	Asbestos	OCP/PCB	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
TP23-0-0.1	Soil	1/2/18		soil jar + bag on ice		X	X	X	X	X				
0.2-0.3														
TP24-0-0.1														
0.2-0.3						X	X	X	X	X				
0.4-0.5														
TP25-0-0.1						X			X	X				
0.2-0.3														
TP26-0-0.1						X	X	X	X	X				
0.2-0.3														
0.5-0.6														
0.9-1.0														
1.4-1.5														
TP27-0-0.1						X	X	X	X	X				
0.2-0.3														
0.5-0.6														
0.9-1.0														
TP28-0-0.1						X			X	X				
0.2-0.3														
0.5-0.6	↓	↓		↓										

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: K. Lim DATE: 2/2/18	CONSIGNMENT NOTE NO.	NAME: [illegible] W	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF: JBS&G	TRANSPORT CO.	DATE: 02/02/18	COOLER TEMP ..... deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE:	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF:	TRANSPORT CO	OF:	COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO Forms013 – Chain of Custody - Generic

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

582994

018708

CHAIN OF CUSTODY

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JBS&G

PROJECT NO.: 54340
PROJECT NAME: St Marys PS1
DATE NEEDED BY: Std.
LABORATORY BATCH NO.:
SAMPLERS: Rob Sharp
QC LEVEL: NEPM (2013)
PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688
SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) KLinz@jbsg.com.au; (3) RSharp@jbsg.com.au
COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H.M	TRH	BTEX	PAHs	Asbestos	OCP/PCB	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
TP29-0-0.1	soil	1/2/18		soil jar + bag on ice										
0.2-0.3						X			XX					
0.5-0.6														
TP30-0-0.1						XX		XX	XX		XX			
0.2-0.3														
0.5-0.6														
TP31-0.0-0.1														
0.2-0.3						X		X	XX					
0.5-0.6														
TP32-0.0-0.1														
0.2-0.3						X			XX					
0.5-0.6														
TP33-0.0-0.1														
0.2-0.3						X			XX					
TP34-0.0-0.1						X		XX	XX		XX			
0.2-0.3														
TP35-0.0-0.1						X			XX					
0.2-0.3														
0.5-0.6														

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: K. Linz DATE: 2/2/18	CONSIGNMENT NOTE NO.	NAME: DATE: 02/02/18	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF: JBS&G	TRANSPORT CO.	OF: Scrudons night	COOLER TEMP ..... deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE:	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF:	TRANSPORT CO	OF:	COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

5829qf

3/4

018708

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: 54340	LABORATORY BATCH NO.:
PROJECT NAME: St marys PS1	SAMPLERS: Rob Sharp
DATE NEEDED BY: Std.	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) RLinz@jbsg.com.au; (3) RSharp@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H.M	TRH	BTEX	PAH	Asbestos	OCP/PCB	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
TP36-0.0-0.1	SOIL	1/2/18		soil jar + bag only										
0.2-0.3						X			X	X				
0.5-0.6														
TP37-0.0-0.1														
0.2-0.3						X	X	X	X	X				
0.5-0.6														
0.9-1.0														
TP38-0.0-0.1						X			X	X				
0.2-0.3														
0.5-0.6														
0.9-1.0														
TP39-0.0-0.1						X	X	X	X	X	X			
0.2-0.3														
TP40-0.0-0.1						X			X	X				
0.2-0.3														
SP01-TP01-0.0-0.1						X			X	X				
SP01-TP02-0.7-0.8														
SP02-TP01-0.9-1.0														
SP02-TP02-3.4-3.5						X	X	X	X	X				

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: L. Lunn DATE: 2/2/18	CONSIGNMENT NOTE NO.	NAME: [illegible]	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF: JBS&G	TRANSPORT CO.	DATE: 05/02/18	
		OF: [illegible]	COOLER TEMP ..... deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE:	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF:	TRANSPORT CO	OF:	COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

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S82902

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018708

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: 54340
PROJECT NAME: St Marys PSI
DATE NEEDED BY: Std.

LABORATORY BATCH NO.:
SAMPLERS: Rob Sharp
QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) RLinz@jbsg.com.au; (3) RSharp@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H.M	PAHs	TRH	BTEX	Asbestos	OCP/PCB	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
SP02-TP03-00-0.1	soil	1/2/18		soil jar + bag on ice		X	X	X	X	X				
0.9-1.0	↓	↓		↓										
4.5-4.6														
FTSP01						X	X	X	X					
FTSP02														
FTSP03						X	X			X				
FTSP03-ACM	fragment			bag						X				
ACMSP-01	↓			↓						X				
ACMSP-02										X				
ACMSP-03	↓			↓						X				
QA 20180201-01	soil			soil jar + bag on ice		X	X	X	X	X				Please forward to enviolab
QC 20180201-01	↓			↓										
QA 20180201-02														Please forward to enviolab
QC 20180201-02	↓	↓		↓										

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: L. Linz DATE: 2/2/18	CONSIGNMENT NOTE NO.	NAME: Jarrod DATE: 02/02/18	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF: JBS&G	TRANSPORT CO.	OF: Ecwise mgt	COOLER TEMP ..... deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE:	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF:	TRANSPORT CO	OF:	COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

Document Set ID: 8477747
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Melbourne
3-5 Kingston Town Close
Oakleigh Vic 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name: **JBS & G Australia (NSW) P/L**

Contact name: Rob Sharp
Project name: ST MARYS PSI
Project ID: 54340
COC number: Not provided
Turn around time: 5 Day
Date/Time received: Feb 2, 2018 3:23 PM
Eurofins | mgt reference: **582994**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 9.1 degrees Celsius.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☒ Split sample sent to requested external lab.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Notes

QC20180201-01 & QC20180201-02 Forwarded to Envirolab| Extra samples received with sampling date 2/2/18 were logged as hold.

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8400 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Rob Sharp - RSharp@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L

018912

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: S43gO	LABORATORY BATCH NO.:
PROJECT NAME: Links Rd	SAMPLERS:
DATE NEEDED BY: STD TAT	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) klinz@jbsg.com.au; (3) rsha-f@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H+M	TRH	BTEX	PAHs	Asbestos	OCP/PCBs	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
TP01 - 0.0-0.1	soil	05/02/18		Jar + Bag onice		X	X	X	X	X				
0.2-0.3														
0.5-0.6														
TP02 - 0.0-0.1						X	X	X	X	X	X			
0.2-0.3														
0.5-0.6														
TP03 - 0.0-0.1						X			X	X				
0.2-0.3														
0.5-0.6														
TP04 - 0.0-0.1						X	X	X	X	X				
0.2-0.3														
0.5-0.6														
TP05 - 0.0-0.1						X	X	X	X	X				
0.2-0.3														
0.5-0.6														
TP06 0.0-0.1						X	X	X	X	X				
0.2-0.3														
0.5-0.6														
TP07 0.0-0.1						X			X	X				

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: Robert Sly DATE: 05/02/18	CONSIGNMENT NOTE NO.	NAME: Jalpa Patel DATE: 6/2/18 10:55AM	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF: JBS&G	TRANSPORT CO.	OF: MGT	COOLER TEMP ..... deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE:	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF:	TRANSPORT CO	OF:	COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO Forms013 – Chain of Custody - Generic

583794

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Version: 1, Version Date: 26/11/2018

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018913

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: S43[illegible]0 | LABORATORY BATCH NO.:
PROJECT NAME: Links Road | SAMPLERS: Robert Sharp
DATE NEEDED BY: STD TAT | QC LEVEL: NEPM (2013)
PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688
SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) Klim2@jbsg.com.au; (3) RSharp@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H. Metals	TRHs	BTEX	PAHs	Asbestos	OCP/PCB	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
TP07 0.2-0.3	soil	05/02		soil Jar - on ice		X	X	X	X					
0.4-0.5														
TP08 0.0-0.1						X	X	X	X					
0.2-0.3														
0.5-0.6														
TP09 0.0-0.1		02/02				X			X					
0.2-0.3														
0.5-0.6														
TP10 0.0-0.1						X	X	X	X					
0.2-0.3														
0.5-0.6														
TP11 0.0-0.1						X	X	X	X					
0.2-0.3														
TP12 0.0-0.1						X	X	X	X	X				
0.2-0.3														
0.5-0.6														
TP13 0-0.1						X	X	X	X	X				
0.2-0.3														

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: Robert Sharp DATE: 05/02/18	CONSIGNMENT NOTE NO.	NAME: Sailpa Patel	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF: JBS&G	TRANSPORT CO.	DATE: 6/2/18 10:55AM	COOLER TEMP ..... deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE:	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF:	TRANSPORT CO	OF:	COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

#583794

Document Set ID: 8477747
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018914

3/3

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: S4340
PROJECT NAME: Eenhs Road
DATE NEEDED BY: STD TAT
LABORATORY BATCH NO.:
SAMPLERS: Robert Stamp / Sam Heaton
QC LEVEL: NEPM (2013)
PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688
SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) RStamp@jbsg.com.au; (3) KLinz@jbsg.com.au
COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H. Metals	TRH	BTEX	PAHs	Asbestos	OCP/PCBs	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
QA20180202-02	soil	02/02		soil + Jar + ice		X	X	X	X	X	X			
QA20180202-03	↓	↓		↓										
QA20180202-04														
QA20180205-01		05/02												
QC20180202-02		02/02				Please forward to Enviro lab								
QC20180202-03		↓				↓								
QC20180202-04														
QC20180205-01	↓	05/02		↓										
TS	water			Vials + ice				X						
TB	↓			↓				X						

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: Robert Stamp DATE: 05/02/18 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: Jaipa Patel DATE: 6/2/18 10:55 AM OF: mnf	COOLER SEAL – Yes..... No ..... Intact ..... Broken ..... COOLER TEMP ..... deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes..... No ..... Intact ..... Broken ..... COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

583794

Document Set ID: 8477747
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018915

CHAIN OF CUSTODY envirolab 1/1

JBS&G

PROJECT NO.: 54340
PROJECT NAME: Cinhs Road
DATE NEEDED BY: STD TAT

LABORATORY BATCH NO.:
SAMPLERS:
QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) RShup@jbsg.com.au; (3) KLinz@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H. Metals	TRH	BTEX	PAHs	Asbestos	OP PCBs	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
QC20180202-02	soil	02/02		Jar + Bag + ICE										Sent Already on Site.
QC20180202-03	↓	↓		↓										
QC20180202-04	↓	↓		↓										
QC20180205-01	↓	02/05		↓										

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: Rhut Shp DATE: 05/02/18 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: Jalpa Patel DATE: 02/18 10:55 AM OF: MGT	COOLER SEAL – Yes..... No ..... Intact ..... Broken ..... COOLER TEMP ..... deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes..... No ..... Intact ..... Broken ..... COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

583794

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

018916

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: S4340
PROJECT NAME: Links Road
DATE NEEDED BY: STD turt.

LABORATORY BATCH NO.:
SAMPLERS:
QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) klinz@jbsg.com.au; (3) esimp@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	11 Metals	TRH	BTEX	PAHs	Asbestos	OCP/PCB	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
TP13 0.0-0.1	Soil	02/02				X	X	X	X	X	X			
0.2-0.3	↓													
0.5-0.6	↓													
TP14_0.0-0.1 ACM	material									X				
TP15 0.0-0.1	Soil					X	X	X	X	X				
0.2-0.3														
TP16 0.0-0.1						X			X	X				
0.2-0.3														
TP17 0.0-0.1						X	X	X	X	X				
0.2-0.3														
TP18 0.0-0.1						X	X	X	X	X	X			
0.2-0.3														
TP19 0.0-0.1						X			X	X				
0.2-0.3														
TP20 0.0-0.1						X	X	X	X	X				
0.2-0.3														
TP21 0.0-0.1						X	X	X	X	X	X			
0.2-0.3														
TP22 0.0-0.1	↓					X			X	X				

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: ULNA	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF: JBS&G	TRANSPORT CO.	DATE: 6/2	COOLER TEMP ..... deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE:	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF:	TRANSPORT CO	OF:	COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

018917

CHAIN OF CUSTODY

2/2

JBS&G

PROJECT NO.: 54340
PROJECT NAME: Links Road
DATE NEEDED BY: STD DAT

LABORATORY BATCH NO.:
SAMPLERS:
QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) Kkinz@jbsg.com.au; (3) RSlump@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H Metals	TRH	BTEX	PAHs	Asbestos	ocp/PCB	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
TP22 0.2-0.3	soil	02/02		Jar + Bag + ice		X			X	X				
FTSP04						X	X	X	X	X				
FTSP07						X	X	X	X	X				
DS-01						X	X	X	X	X	X			
QA20180202-01						X	X	X	X	X	X			
QC20180202-01						Please forward to Envirolab								
TS	water			Vials + ice				X						
TB														

RELINQUISHED BY:
NAME: Robert Slump DATE: 02/02/18
OF: JBS&G

NAME: DATE:
OF:

METHOD OF SHIPMENT:
CONSIGNMENT NOTE NO.
TRANSPORT CO.

CONSIGNMENT NOTE NO.
TRANSPORT CO

RECEIVED BY:
NAME: Vicky
DATE: 6/2
OF:

NAME: DATE:
OF:

FOR RECEIVING LAB USE ONLY:
COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
COOLER TEMP ..... deg C

COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Envirolab

018918

CHAIN OF CUSTODY

envirolab 1/1

JBS&G

PROJECT NO.: S4340
PROJECT NAME: Links Road
DATE NEEDED BY: STD TAT

LABORATORY BATCH NO.:
SAMPLERS: Robert Sluy Sam Heaton.
QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) .....klinz.....@jbsg.com.au; (3) .....RSheaton.....@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H. Metals	TRH	BTEX	PAHs	Asbestos	OCP/PCB	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
QC20180202-01	soil	02/02		Jar + Bag + Ice		X	X	X	X	X	X			

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: Robert Sluy DATE: 02/02	CONSIGNMENT NOTE NO.	NAME: Chelle 6/2	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF: JBS&G	TRANSPORT CO.	DATE: OF: Envirolab Mgt	COOLER TEMP ..... deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE:	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF:	TRANSPORT CO	OF:	COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

Melbourne
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Oakleigh Vic 3166
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NATA # 1261 Site # 23736

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name: **JBS & G Australia (NSW) P/L**

Contact name: Katie Linz
Project name: LINKS RD
Project ID: 54340
COC number: Not provided
Turn around time: 5 Day
Date/Time received: Feb 6, 2018 10:55 AM
Eurofins | mgt reference: **583794**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 9.4 degrees Celsius.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☑ Sample containers for volatile analysis received with zero headspace.

☑ Split sample sent to requested external lab.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Notes

TP10_0.5-0.6 missing | Missing all samples from coc number 018916-18.

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8400 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Katie Linz - klinz@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email

Certificate of Analysis

Accredited for compliance with ISO/IEC 17025–Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention:	Katie Linz
Report	583794-AID
Project Name	LINKS RD
Project ID	54340
Received Date	Feb 06, 2018
Date Reported	Feb 14, 2018

Methodology:

Asbestos Fibre Identification	Conducted in accordance with the Australian Standard AS 4964 – 2004: Method for the Qualitative Identification of Asbestos in Bulk Samples and in-house Method LTM-ASB-8020 by polarised light microscopy (PLM) and dispersion staining (DS) techniques. *NOTE: Positive Trace Analysis results indicate the sample contains detectable respirable fibres.*
Unknown Mineral Fibres	Mineral fibres of unknown type, as determined by PLM with DS, may require another analytical technique, such as Electron Microscopy, to confirm unequivocal identity. *NOTE: While Actinolite, Anthophyllite and Tremolite asbestos may be detected by PLM with DS, due to variability in the optical properties of these materials, AS4964 requires that these are reported as UMF unless confirmed by an independent technique.*
Subsampling Soil Samples	The whole sample submitted is first dried and then passed through a 10mm sieve followed by a 2mm sieve. All fibrous matter greater than 10mm, greater than 2mm as well as the material passing through the 2mm sieve are retained and analysed for the presence of asbestos. If the sub 2mm fraction is greater than approximately 30 to 60g then a sub-sampling routine based on ISO 3082:2009(E) is employed. *NOTE: Depending on the nature and size of the soil sample, the sub-2 mm residue material may need to be sub-sampled for trace analysis, in accordance with AS 4964-2004.*
Bonded asbestos-containing material (ACM)	The material is first examined and any fibres isolated for identification by PLM and DS. Where required, interfering matrices may be removed by disintegration using a range of heat, chemical or physical treatments, possibly in combination.The resultant material is then further examined in accordance with AS 4964 - 2004. *NOTE: Even after disintegration it may be difficult to detect the presence of asbestos in some asbestos-containing bulk materials using PLM and DS. This is due to the low grade or small length or diameter of the asbestos fibres present in the material, or to the fact that very fine fibres have been distributed intimately throughout the materials. Vinyl/asbestos floor tiles, some asbestos-containing sealants and mastics, asbestos-containing epoxy resins and some ore samples are examples of these types of material, which are difficult to analyse.*
Limit of Reporting	The performance limitation of the AS4964 method for inhomogeneous samples is around 0.1 g/kg (0.01% (w/w)). Where no asbestos is found by PLM and DS, including Trace Analysis where required, this is considered to be at the nominal reporting limit of 0.01 % (w / w).The examination of large sample sizes(500 mL is recommended) may improve the likelihood of identifying ACM in the > 2mm fraction.The NEPM screening level of 0.001 % (w / w) asbestos in soil for FA(friable asbestos) and AF(asbestos fines) then applies where they are able to be quantified by gravimetric procedures.This quantitative screening is not generally applicable to FF(free fibres) and results of Trace Analysis are referred. *NOTE: NATA News March 2014, p.7, states in relation to AS4964: "This is a qualitative method with a nominal reporting limit of 0.01%" and that currently in Australia "there is no validated method available for the quantification of asbestos". Accordingly, NATA Accreditation does not cover the performance of this service (indicated with an asterisk).* *This report is consistent with the analytical procedures and reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, 2013 (as amended) and the Western Australia Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia, 2009, including supporting document Recommended Procedures for Laboratory Analysis of Asbestos in Soil, June 2011.*

Project Name LINKS RD
Project ID 54340
Date Sampled Feb 02, 2018 to Feb 05, 2018
Report 583794-AID

Client Sample ID	Eurofins | mgt Sample No.	Date Sampled	Sample Description	Result
TP001_0.0-0.1	18-Fe08671	Feb 05, 2018	Approximate Sample 745g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP02_0.0-0.1	18-Fe08672	Feb 05, 2018	Approximate Sample 906g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP03_0.0-0.1	18-Fe08673	Feb 05, 2018	Approximate Sample 944g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP04_0.0-0.1	18-Fe08674	Feb 05, 2018	Approximate Sample 910g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP05_0.0-0.1	18-Fe08675	Feb 05, 2018	Approximate Sample 889g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP06_0.0-0.1	18-Fe08676	Feb 05, 2018	Approximate Sample 795g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP07_0.0-0.1	18-Fe08677	Feb 05, 2018	Approximate Sample 1034g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP07_0.2-0.3	18-Fe08678	Feb 05, 2018	Approximate Sample 762g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.

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Version: 1, Version Date: 26/11/2018

Client Sample ID	Eurofins | mgt Sample No.	Date Sampled	Sample Description	Result
TP08_0.0-0.1	18-Fe08679	Feb 05, 2018	Approximate Sample 768g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP09_0.0-0.1	18-Fe08680	Feb 02, 2018	Approximate Sample 813g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP10_0.0-0.1	18-Fe08681	Feb 02, 2018	Approximate Sample 702g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP11_0.0-0.1	18-Fe08682	Feb 02, 2018	Approximate Sample 700g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP12_0.0-0.1	18-Fe08683	Feb 02, 2018	Approximate Sample 817g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP13_0.0-0.1	18-Fe08684	Feb 02, 2018	Approximate Sample 760g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
QA20180202-03	18-Fe08685	Feb 02, 2018	Approximate Sample 749g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Asbestos - LTM-ASB-8020	Sydney	Feb 08, 2018	Indefinite

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ABN – 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
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Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: LINKS RD
Project ID: 54340

Order No.:
Report #: 583794
Phone: 02 8245 0300
Fax:

Received: Feb 6, 2018 10:55 AM
Due: Feb 13, 2018
Priority: 5 Day
Contact Name: Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X								
Brisbane Laboratory - NATA Site # 20794														
Perth Laboratory - NATA Site # 23736														
External Laboratory														
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**									
1	TP001_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08671	X		X			X	X	X	X
2	TP02_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08672	X		X	X	X	X	X	X	X
3	TP03_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08673	X		X			X		X	
4	TP04_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08674	X		X			X	X	X	X
5	TP05_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08675	X		X			X	X	X	X
6	TP06_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08676	X		X			X	X	X	X
7	TP07_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08677	X		X			X		X	
8	TP07_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08678	X		X			X	X	X	X
9	TP08_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08679	X		X			X	X	X	X

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Melbourne
3-5 Kingston Town Close
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Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X								
Brisbane Laboratory - NATA Site # 20794														
Perth Laboratory - NATA Site # 23736														
10	TP09_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08680	X		X			X		X	
11	TP10_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08681	X		X			X	X	X	X
12	TP11_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08682	X		X			X	X	X	X
13	TP12_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08683	X		X	X	X	X	X	X	X
14	TP13_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08684	X		X			X	X	X	X
15	QA20180202-03	Feb 02, 2018		Soil	M18-Fe08685	X		X	X	X	X	X	X	X
16	TP01_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08686		X							
17	TP01_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08687		X							
18	TP02_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08688		X							
19	TP02_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08689		X							
20	TP03_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08690		X							

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Sample Detail						Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X								
Brisbane Laboratory - NATA Site # 20794														
Perth Laboratory - NATA Site # 23736														
21	TP03_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08691		X							
22	TP04_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08692		X							
23	TP04_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08693		X							
24	TP05_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08694		X							
25	TP05_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08695		X							
26	TP06_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08696		X							
27	TP06_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08697		X							
28	TP07_0.4-0.5	Feb 05, 2018		Soil	M18-Fe08698		X							
29	TP08_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08699		X							
30	TP08_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08700		X							
31	TP09_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08701		X							
32	TP09_0.5-0.6	Feb 02, 2018		Soil	M18-Fe08702		X							

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Contact Name: Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X								
Brisbane Laboratory - NATA Site # 20794														
Perth Laboratory - NATA Site # 23736														
33	TP10_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08703		X							
34	TP11_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08704		X							
35	TP12_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08705		X							
36	TP12_0.5-0.6	Feb 02, 2018		Soil	M18-Fe08706		X							
37	TP13_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08707		X							
38	QA20180202-02	Feb 02, 2018		Soil	M18-Fe08708		X							
39	QA20180202-04	Feb 02, 2018		Soil	M18-Fe08709		X							
40	QA20180205-01	Feb 05, 2018		Soil	M18-Fe08710		X							
41	TS	Feb 05, 2018		Water	M18-Fe08711							X		
42	TB	Feb 05, 2018		Water	M18-Fe08712							X		

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eurofins | mgt

ABN – 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Feb 6, 2018 10:55 AM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	583794	**Due:**	Feb 13, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Katie Linz
Project Name:	LINKS RD				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail	Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271		X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217	X								
Brisbane Laboratory - NATA Site # 20794									
Perth Laboratory - NATA Site # 23736									
Test Counts	15	25	15	3	3	15	14	15	12

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Internal Quality Control Review and Glossary

General

1. QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Samples were analysed on an 'as received' basis.
4. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

Units

% w/w: weight for weight basis	grams per kilogram
Filter loading:	fibres/100 graticule areas
Reported Concentration:	fibres/mL
Flowrate:	L/min

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis
LOR	Limit of Reporting
COC	Chain of Custody
SRA	Sample Receipt Advice
ISO	International Standards Organisation
AS	Australian Standards
WA DOH	Western Australia Department of Health
NOHSC	National Occupational Health and Safety Commission
ACM	Bonded asbestos-containing material means any material containing more than 1% asbestos and comprises asbestos-containing-material which is in sound condition, although possibly broken or fragmented, and where the asbestos is bound in a matrix such as cement or resin. Common examples of ACM include but are not limited to: pipe and boiler insulation, sprayed-on fireproofing, troweled-on acoustical plaster, floor tile and mastic, floor linoleum, transite shingles, roofing materials, wall and ceiling plaster, ceiling tiles, and gasket materials. This term is restricted to material that cannot pass a 7 mm x 7 mm sieve. This sieve size is selected because it approximates the thickness of common asbestos cement sheeting and for fragments to be smaller than this would imply a high degree of damage and hence potential for fibre release.
FA	FA comprises friable asbestos material and includes severely weathered cement sheet, insulation products and woven asbestos material. This type of friable asbestos is defined here as asbestos material that is in a degraded condition such that it can be broken or crumbled by hand pressure. This material is typically unbonded or was previously bonded and is now significantly degraded (crumbling).
PACM	Presumed Asbestos-Containing Material means thermal system insulation and surfacing material found in buildings, vessels, and vessel sections constructed no later than 1980 that are assumed to contain greater than one percent asbestos but have not been sampled or analyzed to verify or negate the presence of asbestos.
AF	Asbestos fines (AF) are defined as free fibres, or fibre bundles, smaller than 7mm. It is the free fibres which present the greatest risk to human health, although very small fibres (< 5 microns in length) are not considered to be such a risk. AF also includes small fragments of bonded ACM that pass through a 7 mm x 7 mm sieve. (Note that for bonded ACM fragments to pass through a 7 mm x 7 mm sieve implies a substatntial degree of damage which increases the potential for fibre release.)
AC	Asbestos cement means a mixture of cement and asbestos fibres (typically 90:10 ratios).

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Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Qualifier Codes/Comments

Code	Description
N/A	Not applicable

Asbestos Counter/Identifier:

Laxman Dias	Senior Analyst-Asbestos (NSW)

Authorised by:

Sayeed Abu	Senior Analyst-Asbestos (NSW)



Glenn Jackson
National Operations Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

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Certificate of Analysis

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Katie Linz**

Report **583794-S**
Project name LINKS RD
Project ID 54340
Received Date Feb 06, 2018

Client Sample ID			**TP001_0.0-0.1**	**TP02_0.0-0.1**	**TP03_0.0-0.1**	**TP04_0.0-0.1**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**M18-Fe08671**	**M18-Fe08672**	**M18-Fe08673**	**M18-Fe08674**
Date Sampled			**Feb 05, 2018**	**Feb 05, 2018**	**Feb 05, 2018**	**Feb 05, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	-	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	-	< 20
TRH C15-C28	50	mg/kg	57	230	-	< 50
TRH C29-C36	50	mg/kg	70	180	-	160
TRH C10-36 (Total)	50	mg/kg	127	410	-	160
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	-	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	-	< 0.3
4-Bromofluorobenzene (surr.)	1	%	112	105	-	111
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	-	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	-	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	-	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	-	< 50
TRH >C16-C34	100	mg/kg	100	330	-	150
TRH >C34-C40	100	mg/kg	< 100	150	-	200
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	2.5	< 0.5	1.3
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	2.8	0.6	1.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	3.0	1.2	1.8
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	1.2	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	1.8	< 0.5	0.6
Benzo(a)pyrene	0.5	mg/kg	< 0.5	1.9	< 0.5	1.0
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	1.4	< 0.5	0.8
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5	1.3	0.6	1.2
Benzo(k)fluoranthene	0.5	mg/kg	0.5	1.7	< 0.5	0.8
Chrysene	0.5	mg/kg	< 0.5	1.9	< 0.5	0.7
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5

Client Sample ID			TP001_0.0-0.1	TP02_0.0-0.1	TP03_0.0-0.1	TP04_0.0-0.1
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**M18-Fe08671**	**M18-Fe08672**	**M18-Fe08673**	**M18-Fe08674**
Date Sampled			**Feb 05, 2018**	**Feb 05, 2018**	**Feb 05, 2018**	**Feb 05, 2018**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Fluoranthene	0.5	mg/kg	1.2	5.5	0.6	1.5
Fluorene	0.5	mg/kg	< 0.5	0.5	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	1.1	< 0.5	1.0
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	1.4	7.5	< 0.5	0.8
Pyrene	0.5	mg/kg	1.2	4.9	0.6	1.5
Total PAH*	0.5	mg/kg	4.3	30.7	1.8	9.9
2-Fluorobiphenyl (surr.)	1	%	95	90	82	83
p-Terphenyl-d14 (surr.)	1	%	84	77	87	83
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	-	< 0.1	-	-
4.4'-DDD	0.05	mg/kg	-	< 0.05	-	-
4.4'-DDE	0.05	mg/kg	-	< 0.05	-	-
4.4'-DDT	0.05	mg/kg	-	< 0.05	-	-
a-BHC	0.05	mg/kg	-	< 0.05	-	-
Aldrin	0.05	mg/kg	-	< 0.05	-	-
b-BHC	0.05	mg/kg	-	< 0.05	-	-
d-BHC	0.05	mg/kg	-	< 0.05	-	-
Dieldrin	0.05	mg/kg	-	< 0.05	-	-
Endosulfan I	0.05	mg/kg	-	< 0.05	-	-
Endosulfan II	0.05	mg/kg	-	< 0.05	-	-
Endosulfan sulphate	0.05	mg/kg	-	< 0.05	-	-
Endrin	0.05	mg/kg	-	< 0.05	-	-
Endrin aldehyde	0.05	mg/kg	-	< 0.05	-	-
Endrin ketone	0.05	mg/kg	-	< 0.05	-	-
g-BHC (Lindane)	0.05	mg/kg	-	< 0.05	-	-
Heptachlor	0.05	mg/kg	-	< 0.05	-	-
Heptachlor epoxide	0.05	mg/kg	-	< 0.05	-	-
Hexachlorobenzene	0.05	mg/kg	-	< 0.05	-	-
Methoxychlor	0.05	mg/kg	-	< 0.05	-	-
Toxaphene	1	mg/kg	-	< 1	-	-
Aldrin and Dieldrin (Total)*	0.05	mg/kg	-	< 0.05	-	-
DDT + DDE + DDD (Total)*	0.05	mg/kg	-	< 0.05	-	-
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	-	< 0.1	-	-
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	-	< 0.1	-	-
Dibutylchlorendate (surr.)	1	%	-	91	-	-
Tetrachloro-m-xylene (surr.)	1	%	-	65	-	-
Polychlorinated Biphenyls						
Aroclor-1016	0.1	mg/kg	-	< 0.1	-	-
Aroclor-1221	0.1	mg/kg	-	< 0.1	-	-
Aroclor-1232	0.1	mg/kg	-	< 0.1	-	-
Aroclor-1242	0.1	mg/kg	-	< 0.1	-	-
Aroclor-1248	0.1	mg/kg	-	< 0.1	-	-
Aroclor-1254	0.1	mg/kg	-	< 0.1	-	-
Aroclor-1260	0.1	mg/kg	-	< 0.1	-	-
Total PCB*	0.1	mg/kg	-	< 0.1	-	-
Dibutylchlorendate (surr.)	1	%	-	91	-	-
Tetrachloro-m-xylene (surr.)	1	%	-	65	-	-

Client Sample ID			TP001_0.0-0.1	TP02_0.0-0.1	TP03_0.0-0.1	TP04_0.0-0.1
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**M18-Fe08671**	**M18-Fe08672**	**M18-Fe08673**	**M18-Fe08674**
Date Sampled			**Feb 05, 2018**	**Feb 05, 2018**	**Feb 05, 2018**	**Feb 05, 2018**
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	2	mg/kg	4.1	5.2	< 2	4.6
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	86	41	18	36
Copper	5	mg/kg	37	33	14	56
Lead	5	mg/kg	35	35	19	41
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	65	39	16	47
Zinc	5	mg/kg	140	230	52	440
% Moisture	1	%	8.3	7.4	5.0	6.7

Client Sample ID			TP05_0.0-0.1	TP06_0.0-0.1	TP07_0.0-0.1	TP07_0.2-0.3
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**M18-Fe08675**	**M18-Fe08676**	**M18-Fe08677**	**M18-Fe08678**
Date Sampled			**Feb 05, 2018**	**Feb 05, 2018**	**Feb 05, 2018**	**Feb 05, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	-	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	-	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	-	210
TRH C29-C36	50	mg/kg	< 50	< 50	-	110
TRH C10-36 (Total)	50	mg/kg	< 50	< 50	-	320
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	-	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	-	< 0.3
4-Bromofluorobenzene (surr.)	1	%	122	123	-	107
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	-	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	-	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	-	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	-	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	-	280
TRH >C34-C40	100	mg/kg	< 100	< 100	-	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	2.8	1.0	2.9	8.2
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	2.8	1.3	3.1	8.2
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	2.8	1.5	3.4	8.2
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	0.6
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5	0.5	1.9
Benz(a)anthracene	0.5	mg/kg	1.0	< 0.5	1.7	4.8
Benzo(a)pyrene	0.5	mg/kg	1.7	0.8	2.2	5.3
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	1.0	0.5	1.8	4.9

Client Sample ID			TP05_0.0-0.1	TP06_0.0-0.1	TP07_0.0-0.1	TP07_0.2-0.3
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			M18-Fe08675	M18-Fe08676	M18-Fe08677	M18-Fe08678
Date Sampled			Feb 05, 2018	Feb 05, 2018	Feb 05, 2018	Feb 05, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Benzo(g.h.i)perylene	0.5	mg/kg	1.4	0.8	1.5	3.5
Benzo(k)fluoranthene	0.5	mg/kg	1.3	0.5	1.7	4.0
Chrysene	0.5	mg/kg	1.1	0.6	1.9	4.6
Dibenz(a.h)anthracene	0.5	mg/kg	0.6	< 0.5	< 0.5	1.1
Fluoranthene	0.5	mg/kg	1.3	1.1	3.9	12
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	1.5	0.7	1.3	3.0
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	1.3	0.6	1.8	7.6
Pyrene	0.5	mg/kg	1.4	1.1	3.8	11
Total PAH*	0.5	mg/kg	13.6	6.7	22.1	64.3
2-Fluorobiphenyl (surr.)	1	%	81	80	87	75
p-Terphenyl-d14 (surr.)	1	%	89	86	88	72
Heavy Metals						
Arsenic	2	mg/kg	6.2	5.7	5.2	12
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	28	76	32	27
Copper	5	mg/kg	15	25	26	20
Lead	5	mg/kg	33	36	34	34
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	13	46	26	13
Zinc	5	mg/kg	98	170	180	180
% Moisture	1	%	7.1	6.5	4.6	7.6

Client Sample ID			TP08_0.0-0.1	TP09_0.0-0.1	TP10_0.0-0.1	TP11_0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			M18-Fe08679	M18-Fe08680	M18-Fe08681	M18-Fe08682
Date Sampled			Feb 05, 2018	Feb 02, 2018	Feb 02, 2018	Feb 02, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	-	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	-	< 20	< 20
TRH C15-C28	50	mg/kg	65	-	< 50	< 50
TRH C29-C36	50	mg/kg	150	-	< 50	< 50
TRH C10-36 (Total)	50	mg/kg	215	-	< 50	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	-	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	-	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	116	-	122	109

Client Sample ID			TP08_0.0-0.1	TP09_0.0-0.1	TP10_0.0-0.1	TP11_0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			M18-Fe08679	M18-Fe08680	M18-Fe08681	M18-Fe08682
Date Sampled			Feb 05, 2018	Feb 02, 2018	Feb 02, 2018	Feb 02, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	-	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	-	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	-	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	-	< 50	< 50
TRH >C16-C34	100	mg/kg	170	-	< 100	< 100
TRH >C34-C40	100	mg/kg	120	-	< 100	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	1.8	< 0.5	< 0.5	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	2.1	0.6	0.6	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	2.3	1.2	1.2	1.2
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	1.0	< 0.5	< 0.5	< 0.5
Benzo(a)pyrene	0.5	mg/kg	1.4	< 0.5	< 0.5	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	1.2	< 0.5	< 0.5	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	1.0	< 0.5	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	0.9	< 0.5	< 0.5	< 0.5
Chrysene	0.5	mg/kg	1.3	< 0.5	< 0.5	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Fluoranthene	0.5	mg/kg	2.2	< 0.5	< 0.5	< 0.5
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	0.7	< 0.5	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	1.3	< 0.5	< 0.5	< 0.5
Pyrene	0.5	mg/kg	2.1	< 0.5	< 0.5	< 0.5
Total PAH*	0.5	mg/kg	13.1	< 0.5	< 0.5	< 0.5
2-Fluorobiphenyl (surr.)	1	%	76	82	87	78
p-Terphenyl-d14 (surr.)	1	%	69	86	85	80
Heavy Metals						
Arsenic	2	mg/kg	5.7	6.7	6.4	7.0
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	15	21	26	22
Copper	5	mg/kg	29	13	6.8	8.8
Lead	5	mg/kg	29	31	16	14
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	9.0	7.6	< 5	5.0
Zinc	5	mg/kg	100	550	16	13
% Moisture	1	%	7.5	16	9.2	7.3

Client Sample ID			TP12_0.0-0.1	TP13_0.0-0.1	QA20180202-03
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**M18-Fe08683**	**M18-Fe08684**	**M18-Fe08685**
Date Sampled			**Feb 02, 2018**	**Feb 02, 2018**	**Feb 02, 2018**
Test/Reference	LOR	Unit			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					
TRH C6-C9	20	mg/kg	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	170	< 50
TRH C29-C36	50	mg/kg	< 50	72	< 50
TRH C10-36 (Total)	50	mg/kg	< 50	242	< 50
BTEX					
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	104	125	78
Total Recoverable Hydrocarbons - 2013 NEPM Fractions					
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	200	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100
Polycyclic Aromatic Hydrocarbons					
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	6.3	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	6.3	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	6.3	1.2
Acenaphthene	0.5	mg/kg	< 0.5	0.9	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	2.1	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	3.8	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	4.3	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	2.8	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5	2.9	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	3.4	< 0.5
Chrysene	0.5	mg/kg	< 0.5	4.0	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	0.7	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5	13	< 0.5
Fluorene	0.5	mg/kg	< 0.5	1.4	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	2.3	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	15	< 0.5
Pyrene	0.5	mg/kg	< 0.5	12	< 0.5
Total PAH*	0.5	mg/kg	< 0.5	68.6	< 0.5
2-Fluorobiphenyl (surr.)	1	%	82	74	78
p-Terphenyl-d14 (surr.)	1	%	80	69	70

Client Sample ID			TP12_0.0-0.1	TP13_0.0-0.1	QA20180202-03
Sample Matrix			Soil	Soil	Soil
Eurofins | mgt Sample No.			M18-Fe08683	M18-Fe08684	M18-Fe08685
Date Sampled			Feb 02, 2018	Feb 02, 2018	Feb 02, 2018
Test/Reference	LOR	Unit			
Organochlorine Pesticides					
Chlordanes - Total	0.1	mg/kg	< 0.1	-	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05	-	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05	-	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05	-	< 0.05
a-BHC	0.05	mg/kg	< 0.05	-	< 0.05
Aldrin	0.05	mg/kg	< 0.05	-	< 0.05
b-BHC	0.05	mg/kg	< 0.05	-	< 0.05
d-BHC	0.05	mg/kg	< 0.05	-	< 0.05
Dieldrin	0.05	mg/kg	< 0.05	-	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05	-	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05	-	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	< 0.05
Endrin	0.05	mg/kg	< 0.05	-	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05	-	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05	-	< 0.05
g-BHC (Lindane)	0.05	mg/kg	< 0.05	-	< 0.05
Heptachlor	0.05	mg/kg	< 0.05	-	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05	-	< 0.05
Toxaphene	1	mg/kg	< 1	-	< 1
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	-	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	-	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1
Dibutylchlorendate (surr.)	1	%	102	-	111
Tetrachloro-m-xylene (surr.)	1	%	84	-	91
Polychlorinated Biphenyls					
Aroclor-1016	0.1	mg/kg	< 0.1	-	< 0.1
Aroclor-1221	0.1	mg/kg	< 0.1	-	< 0.1
Aroclor-1232	0.1	mg/kg	< 0.1	-	< 0.1
Aroclor-1242	0.1	mg/kg	< 0.1	-	< 0.1
Aroclor-1248	0.1	mg/kg	< 0.1	-	< 0.1
Aroclor-1254	0.1	mg/kg	< 0.1	-	< 0.1
Aroclor-1260	0.1	mg/kg	< 0.1	-	< 0.1
Total PCB*	0.1	mg/kg	< 0.1	-	< 0.1
Dibutylchlorendate (surr.)	1	%	102	-	111
Tetrachloro-m-xylene (surr.)	1	%	84	-	91
Heavy Metals					
Arsenic	2	mg/kg	6.4	6.9	6.9
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	19	20	24
Copper	5	mg/kg	7.3	10	7.9
Lead	5	mg/kg	27	33	30
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	< 5	< 5	< 5
Zinc	5	mg/kg	19	35	24
% Moisture	1	%	8.1	12	9.1

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Feb 10, 2018	14 Day
- Method: LTM-ORG-2010 TRH C6-C36			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Feb 10, 2018	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Feb 10, 2018	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
BTEX	Melbourne	Feb 10, 2018	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Polycyclic Aromatic Hydrocarbons	Melbourne	Feb 10, 2018	14 Day
- Method: LTM-ORG-2130 PAH and Phenols in Soils by GCMS			
Organochlorine Pesticides	Melbourne	Feb 10, 2018	14 Day
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water			
Polychlorinated Biphenyls	Melbourne	Feb 10, 2018	28 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water			
Metals M8	Melbourne	Feb 10, 2018	28 Days
- Method: LTM-MET-3030 by ICP-OES (hydride ICP-OES for Mercury)			
% Moisture	Melbourne	Feb 08, 2018	14 Day
- Method: LTM-GEN-7080 Moisture			

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ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Feb 6, 2018 10:55 AM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	583794	**Due:**	Feb 13, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Katie Linz
Project Name:	LINKS RD				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X								
Brisbane Laboratory - NATA Site # 20794														
Perth Laboratory - NATA Site # 23736														
External Laboratory														
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**									
1	TP01_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08671	X		X			X	X	X	X
2	TP02_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08672	X		X	X	X	X	X	X	X
3	TP03_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08673	X		X			X		X	
4	TP04_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08674	X		X			X	X	X	X
5	TP05_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08675	X		X			X	X	X	X
6	TP06_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08676	X		X			X	X	X	X
7	TP07_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08677	X		X			X		X	
8	TP07_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08678	X		X			X	X	X	X
9	TP08_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08679	X		X			X	X	X	X

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web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

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2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
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		Fax:		**Contact Name:**	Katie Linz
Project Name:	LINKS RD				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X								
Brisbane Laboratory - NATA Site # 20794														
Perth Laboratory - NATA Site # 23736														
10	TP09_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08680	X		X			X		X	
11	TP10_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08681	X		X			X	X	X	X
12	TP11_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08682	X		X			X	X	X	X
13	TP12_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08683	X		X	X	X	X	X	X	X
14	TP13_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08684	X		X			X	X	X	X
15	QA20180202-03	Feb 02, 2018		Soil	M18-Fe08685	X		X	X	X	X	X	X	X
16	TP01_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08686		X							
17	TP01_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08687		X							
18	TP02_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08688		X							
19	TP02_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08689		X							
20	TP03_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08690		X							

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web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
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NATA # 1261
Site # 1254 & 14271

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Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
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1/21 Smallwood Place
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		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Katie Linz
Project Name:	LINKS RD				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X								
Brisbane Laboratory - NATA Site # 20794														
Perth Laboratory - NATA Site # 23736														
21	TP03_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08691		X							
22	TP04_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08692		X							
23	TP04_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08693		X							
24	TP05_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08694		X							
25	TP05_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08695		X							
26	TP06_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08696		X							
27	TP06_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08697		X							
28	TP07_0.4-0.5	Feb 05, 2018		Soil	M18-Fe08698		X							
29	TP08_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08699		X							
30	TP08_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08700		X							
31	TP09_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08701		X							
32	TP09_0.5-0.6	Feb 02, 2018		Soil	M18-Fe08702		X							

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web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
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		Fax:		**Contact Name:**	Katie Linz
Project Name:	LINKS RD				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X								
Brisbane Laboratory - NATA Site # 20794														
Perth Laboratory - NATA Site # 23736														
33	TP10_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08703		X							
34	TP11_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08704		X							
35	TP12_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08705		X							
36	TP12_0.5-0.6	Feb 02, 2018		Soil	M18-Fe08706		X							
37	TP13_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08707		X							
38	QA20180202-02	Feb 02, 2018		Soil	M18-Fe08708		X							
39	QA20180202-04	Feb 02, 2018		Soil	M18-Fe08709		X							
40	QA20180205-01	Feb 05, 2018		Soil	M18-Fe08710		X							
41	TS	Feb 05, 2018		Water	M18-Fe08711							X		
42	TB	Feb 05, 2018		Water	M18-Fe08712							X		

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Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Feb 6, 2018 10:55 AM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	583794	**Due:**	Feb 13, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Katie Linz
Project Name:	LINKS RD				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail	Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271		X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217	X								
Brisbane Laboratory - NATA Site # 20794									
Perth Laboratory - NATA Site # 23736									
Test Counts	15	25	15	3	3	15	14	15	12

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Organochlorine Pesticides							
Chlordanes - Total	mg/kg	< 0.1			0.1	Pass	
4.4'-DDD	mg/kg	< 0.05			0.05	Pass	
4.4'-DDE	mg/kg	< 0.05			0.05	Pass	
4.4'-DDT	mg/kg	< 0.05			0.05	Pass	
a-BHC	mg/kg	< 0.05			0.05	Pass	
Aldrin	mg/kg	< 0.05			0.05	Pass	
b-BHC	mg/kg	< 0.05			0.05	Pass	
d-BHC	mg/kg	< 0.05			0.05	Pass	
Dieldrin	mg/kg	< 0.05			0.05	Pass	
Endosulfan I	mg/kg	< 0.05			0.05	Pass	
Endosulfan II	mg/kg	< 0.05			0.05	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endosulfan sulphate	mg/kg	< 0.05			0.05	Pass	
Endrin	mg/kg	< 0.05			0.05	Pass	
Endrin aldehyde	mg/kg	< 0.05			0.05	Pass	
Endrin ketone	mg/kg	< 0.05			0.05	Pass	
g-BHC (Lindane)	mg/kg	< 0.05			0.05	Pass	
Heptachlor	mg/kg	< 0.05			0.05	Pass	
Heptachlor epoxide	mg/kg	< 0.05			0.05	Pass	
Hexachlorobenzene	mg/kg	< 0.05			0.05	Pass	
Methoxychlor	mg/kg	< 0.05			0.05	Pass	
Toxaphene	mg/kg	< 1			1	Pass	
Method Blank							
Polychlorinated Biphenyls							
Aroclor-1016	mg/kg	< 0.1			0.1	Pass	
Aroclor-1221	mg/kg	< 0.1			0.1	Pass	
Aroclor-1232	mg/kg	< 0.1			0.1	Pass	
Aroclor-1242	mg/kg	< 0.1			0.1	Pass	
Aroclor-1248	mg/kg	< 0.1			0.1	Pass	
Aroclor-1254	mg/kg	< 0.1			0.1	Pass	
Aroclor-1260	mg/kg	< 0.1			0.1	Pass	
Total PCB*	mg/kg	< 0.1			0.1	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	125			70-130	Pass	
TRH C10-C14	%	96			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	120			70-130	Pass	
Toluene	%	124			70-130	Pass	
Ethylbenzene	%	123			70-130	Pass	
m&p-Xylenes	%	124			70-130	Pass	
Xylenes - Total	%	123			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	83			70-130	Pass	
TRH C6-C10	%	114			70-130	Pass	
TRH >C10-C16	%	95			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	96			70-130	Pass	
Acenaphthylene	%	101			70-130	Pass	
Anthracene	%	101			70-130	Pass	
Benz(a)anthracene	%	90			70-130	Pass	
Benzo(a)pyrene	%	91			70-130	Pass	
Benzo(b&j)fluoranthene	%	100			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzo(g.h.i)perylene	%	74			70-130	Pass	
Benzo(k)fluoranthene	%	105			70-130	Pass	
Chrysene	%	96			70-130	Pass	
Dibenz(a.h)anthracene	%	80			70-130	Pass	
Fluoranthene	%	97			70-130	Pass	
Fluorene	%	101			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	72			70-130	Pass	
Naphthalene	%	94			70-130	Pass	
Phenanthrene	%	100			70-130	Pass	
Pyrene	%	101			70-130	Pass	
LCS - % Recovery							
Organochlorine Pesticides							
4.4'-DDD	%	105			70-130	Pass	
4.4'-DDE	%	111			70-130	Pass	
4.4'-DDT	%	115			70-130	Pass	
a-BHC	%	97			70-130	Pass	
Aldrin	%	103			70-130	Pass	
b-BHC	%	95			70-130	Pass	
d-BHC	%	92			70-130	Pass	
Dieldrin	%	106			70-130	Pass	
Endosulfan I	%	105			70-130	Pass	
Endosulfan II	%	100			70-130	Pass	
Endosulfan sulphate	%	107			70-130	Pass	
Endrin	%	113			70-130	Pass	
Endrin aldehyde	%	103			70-130	Pass	
Endrin ketone	%	110			70-130	Pass	
g-BHC (Lindane)	%	97			70-130	Pass	
Heptachlor	%	102			70-130	Pass	
Heptachlor epoxide	%	102			70-130	Pass	
Hexachlorobenzene	%	95			70-130	Pass	
Methoxychlor	%	111			70-130	Pass	
LCS - % Recovery							
Polychlorinated Biphenyls							
Aroclor-1260	%	92			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	108			80-120	Pass	
Cadmium	%	110			80-120	Pass	
Chromium	%	108			80-120	Pass	
Copper	%	102			80-120	Pass	
Lead	%	111			80-120	Pass	
Mercury	%	92			75-125	Pass	
Nickel	%	104			80-120	Pass	
Zinc	%	109			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M18-Fe08672	CP	%	95			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M18-Fe08672	CP	%	92			70-130	Pass	
Spike - % Recovery									
Organochlorine Pesticides				Result 1					
4.4'-DDD	S18-Fe08017	NCP	%	102			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
4.4'-DDE	S18-Fe08017	NCP	%	121			70-130	Pass	
4.4'-DDT	S18-Fe08017	NCP	%	96			70-130	Pass	
a-BHC	S18-Fe08017	NCP	%	121			70-130	Pass	
Aldrin	S18-Fe08017	NCP	%	108			70-130	Pass	
b-BHC	S18-Fe08017	NCP	%	117			70-130	Pass	
d-BHC	S18-Fe08017	NCP	%	89			70-130	Pass	
Dieldrin	S18-Fe08017	NCP	%	112			70-130	Pass	
Endosulfan I	S18-Fe08017	NCP	%	111			70-130	Pass	
Endosulfan II	S18-Fe08017	NCP	%	112			70-130	Pass	
Endosulfan sulphate	S18-Fe08017	NCP	%	113			70-130	Pass	
Endrin	S18-Fe08017	NCP	%	113			70-130	Pass	
Endrin aldehyde	S18-Fe08017	NCP	%	103			70-130	Pass	
Endrin ketone	S18-Fe08017	NCP	%	115			70-130	Pass	
g-BHC (Lindane)	S18-Fe08017	NCP	%	123			70-130	Pass	
Heptachlor	S18-Fe08017	NCP	%	99			70-130	Pass	
Heptachlor epoxide	S18-Fe08017	NCP	%	106			70-130	Pass	
Hexachlorobenzene	S18-Fe08017	NCP	%	120			70-130	Pass	
Methoxychlor	S18-Fe08017	NCP	%	94			70-130	Pass	
Spike - % Recovery									
Polychlorinated Biphenyls				Result 1					
Aroclor-1260	M18-Fe08672	CP	%	105			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	M18-Fe08674	CP	%	88			70-130	Pass	
Acenaphthylene	M18-Fe08674	CP	%	93			70-130	Pass	
Anthracene	M18-Fe08674	CP	%	91			70-130	Pass	
Benz(a)anthracene	M18-Fe08674	CP	%	97			70-130	Pass	
Benzo(a)pyrene	M18-Fe08674	CP	%	96			70-130	Pass	
Benzo(b&j)fluoranthene	M18-Fe08674	CP	%	102			70-130	Pass	
Benzo(g.h.i)perylene	M18-Fe08674	CP	%	100			70-130	Pass	
Benzo(k)fluoranthene	M18-Fe08674	CP	%	101			70-130	Pass	
Chrysene	M18-Fe08674	CP	%	93			70-130	Pass	
Dibenz(a.h)anthracene	M18-Fe08674	CP	%	126			70-130	Pass	
Fluoranthene	M18-Fe08674	CP	%	91			70-130	Pass	
Fluorene	M18-Fe08674	CP	%	92			70-130	Pass	
Indeno(1.2.3-cd)pyrene	M18-Fe08674	CP	%	111			70-130	Pass	
Naphthalene	M18-Fe08674	CP	%	84			70-130	Pass	
Phenanthrene	M18-Fe08674	CP	%	100			70-130	Pass	
Pyrene	M18-Fe08674	CP	%	94			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	M18-Fe08675	CP	%	106			75-125	Pass	
Cadmium	M18-Fe08675	CP	%	109			75-125	Pass	
Chromium	M18-Fe08675	CP	%	104			75-125	Pass	
Copper	M18-Fe08675	CP	%	100			75-125	Pass	
Lead	M18-Fe08675	CP	%	103			75-125	Pass	
Mercury	M18-Fe08675	CP	%	89			70-130	Pass	
Nickel	M18-Fe08675	CP	%	102			75-125	Pass	
Zinc	M18-Fe08675	CP	%	83			75-125	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M18-Fe08682	CP	%	106			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzene	M18-Fe08682	CP	%	90			70-130	Pass	
Toluene	M18-Fe08682	CP	%	110			70-130	Pass	
Ethylbenzene	M18-Fe08682	CP	%	124			70-130	Pass	
m&p-Xylenes	M18-Fe08682	CP	%	121			70-130	Pass	
o-Xylene	M18-Fe08682	CP	%	124			70-130	Pass	
Xylenes - Total	M18-Fe08682	CP	%	122			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M18-Fe08682	CP	%	94			70-130	Pass	
TRH C6-C10	M18-Fe08682	CP	%	100			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	M18-Fe08671	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M18-Fe08671	CP	mg/kg	57	< 50	19	30%	Pass	
TRH C29-C36	M18-Fe08671	CP	mg/kg	70	66	7.0	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	M18-Fe08671	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	M18-Fe08671	CP	mg/kg	100	< 100	14	30%	Pass	
TRH >C34-C40	M18-Fe08671	CP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Chlordanes - Total	S18-Fe08022	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
4.4'-DDD	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDE	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDT	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-BHC	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Aldrin	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-BHC	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-BHC	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin aldehyde	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-BHC (Lindane)	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor epoxide	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	S18-Fe08022	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Toxaphene	S18-Fe08022	NCP	mg/kg	< 1	< 1	<1	30%	Pass	
Duplicate									
Polychlorinated Biphenyls				Result 1	Result 2	RPD			
Aroclor-1016	S18-Fe08022	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1221	S18-Fe08022	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1232	S18-Fe08022	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1242	S18-Fe08022	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1248	S18-Fe08022	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1254	S18-Fe08022	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1260	S18-Fe08022	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Total PCB*	S18-Fe08022	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	

Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M18-Fe08672	CP	%	7.4	6.1	19	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M18-Fe08673	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	M18-Fe08673	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	M18-Fe08673	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	M18-Fe08673	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	M18-Fe08673	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	M18-Fe08673	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	M18-Fe08673	CP	mg/kg	0.6	0.5	3.0	30%	Pass	
Benzo(k)fluoranthene	M18-Fe08673	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	M18-Fe08673	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	M18-Fe08673	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	M18-Fe08673	CP	mg/kg	0.6	< 0.5	15	30%	Pass	
Fluorene	M18-Fe08673	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M18-Fe08673	CP	mg/kg	< 0.5	0.5	12	30%	Pass	
Naphthalene	M18-Fe08673	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	M18-Fe08673	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	M18-Fe08673	CP	mg/kg	0.6	0.5	16	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	M18-Fe08674	CP	mg/kg	4.6	5.4	16	30%	Pass	
Cadmium	M18-Fe08674	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	M18-Fe08674	CP	mg/kg	36	35	2.0	30%	Pass	
Copper	M18-Fe08674	CP	mg/kg	56	59	6.0	30%	Pass	
Lead	M18-Fe08674	CP	mg/kg	41	42	4.0	30%	Pass	
Mercury	M18-Fe08674	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	M18-Fe08674	CP	mg/kg	47	44	8.0	30%	Pass	
Zinc	M18-Fe08674	CP	mg/kg	440	480	7.0	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	M18-Fe08675	CP	mg/kg	6.2	6.3	2.0	30%	Pass	
Cadmium	M18-Fe08675	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	M18-Fe08675	CP	mg/kg	28	29	1.0	30%	Pass	
Copper	M18-Fe08675	CP	mg/kg	15	15	2.0	30%	Pass	
Lead	M18-Fe08675	CP	mg/kg	33	33	<1	30%	Pass	
Mercury	M18-Fe08675	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	M18-Fe08675	CP	mg/kg	13	13	2.0	30%	Pass	
Zinc	M18-Fe08675	CP	mg/kg	98	99	1.0	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M18-Fe08681	CP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M18-Fe08681	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	M18-Fe08681	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	M18-Fe08681	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	M18-Fe08681	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	M18-Fe08681	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	M18-Fe08681	CP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M18-Fe08681	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	M18-Fe08681	CP	mg/kg	< 20	< 20	<1	30%	Pass	

Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M18-Fe08682	CP	%	7.3	7.1	2.0	30%	Pass	

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Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised By

Nibha Vaidya	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Harry Bacalis	Senior Analyst-Volatile (VIC)
Huong Le	Senior Analyst-Inorganic (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Nibha Vaidya	Senior Analyst-Asbestos (NSW)



Glenn Jackson

National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Celebrating 30 years Testing and Protecting Human Health

Certificate of Analysis

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Katie Linz**

Report **583794-W**
Project name LINKS RD
Project ID 54340
Received Date Feb 06, 2018

Client Sample ID			R20 **TS**	**TB**
Sample Matrix			**Water**	**Water**
Eurofins | mgt Sample No.			**M18-Fe08711**	**M18-Fe08712**
Date Sampled			**Feb 05, 2018**	**Feb 05, 2018**
Test/Reference	LOR	Unit		
BTEX				
Benzene	0.001	mg/L	96	< 0.001
Toluene	0.001	mg/L	100	< 0.001
Ethylbenzene	0.001	mg/L	88	< 0.001
m&p-Xylenes	0.002	mg/L	88	< 0.002
o-Xylene	0.001	mg/L	89	< 0.001
Xylenes - Total	0.003	mg/L	89	< 0.003
4-Bromofluorobenzene (surr.)	1	%	115	116

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
BTEX	Melbourne	Feb 09, 2018	14 Day

- Method: TRH C6-C40 - LTM-ORG-2010

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ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: LINKS RD
Project ID: 54340

Order No.:
Report #: 583794
Phone: 02 8245 0300
Fax:

Received: Feb 6, 2018 10:55 AM
Due: Feb 13, 2018
Priority: 5 Day
Contact Name: Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X								
Brisbane Laboratory - NATA Site # 20794														
Perth Laboratory - NATA Site # 23736														
External Laboratory														
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**									
1	TP01_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08671	X		X			X	X	X	X
2	TP02_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08672	X		X	X	X	X	X	X	X
3	TP03_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08673	X		X			X		X	
4	TP04_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08674	X		X			X	X	X	X
5	TP05_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08675	X		X			X	X	X	X
6	TP06_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08676	X		X			X	X	X	X
7	TP07_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08677	X		X			X		X	
8	TP07_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08678	X		X			X	X	X	X
9	TP08_0.0-0.1	Feb 05, 2018		Soil	M18-Fe08679	X		X			X	X	X	X

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e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: LINKS RD
Project ID: 54340

Order No.:
Report #: 583794
Phone: 02 8245 0300
Fax:

Received: Feb 6, 2018 10:55 AM
Due: Feb 13, 2018
Priority: 5 Day
Contact Name: Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X								
Brisbane Laboratory - NATA Site # 20794														
Perth Laboratory - NATA Site # 23736														
10	TP09_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08680	X		X			X		X	
11	TP10_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08681	X		X			X	X	X	X
12	TP11_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08682	X		X			X	X	X	X
13	TP12_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08683	X		X	X	X	X	X	X	X
14	TP13_0.0-0.1	Feb 02, 2018		Soil	M18-Fe08684	X		X			X	X	X	X
15	QA20180202-03	Feb 02, 2018		Soil	M18-Fe08685	X		X	X	X	X	X	X	X
16	TP01_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08686		X							
17	TP01_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08687		X							
18	TP02_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08688		X							
19	TP02_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08689		X							
20	TP03_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08690		X							

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ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Feb 6, 2018 10:55 AM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	583794	**Due:**	Feb 13, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Katie Linz
Project Name:	LINKS RD				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X								
Brisbane Laboratory - NATA Site # 20794														
Perth Laboratory - NATA Site # 23736														
21	TP03_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08691		X							
22	TP04_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08692		X							
23	TP04_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08693		X							
24	TP05_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08694		X							
25	TP05_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08695		X							
26	TP06_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08696		X							
27	TP06_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08697		X							
28	TP07_0.4-0.5	Feb 05, 2018		Soil	M18-Fe08698		X							
29	TP08_0.2-0.3	Feb 05, 2018		Soil	M18-Fe08699		X							
30	TP08_0.5-0.6	Feb 05, 2018		Soil	M18-Fe08700		X							
31	TP09_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08701		X							
32	TP09_0.5-0.6	Feb 02, 2018		Soil	M18-Fe08702		X							

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web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

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Unit F3, Building F
16 Mars Road
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2/91 Leach Highway
Kewdale WA 6105
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NATA # 1261
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Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: LINKS RD
Project ID: 54340

Order No.:
Report #: 583794
Phone: 02 8245 0300
Fax:

Received: Feb 6, 2018 10:55 AM
Due: Feb 13, 2018
Priority: 5 Day
Contact Name: Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X								
Brisbane Laboratory - NATA Site # 20794														
Perth Laboratory - NATA Site # 23736														
33	TP10_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08703		X							
34	TP11_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08704		X							
35	TP12_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08705		X							
36	TP12_0.5-0.6	Feb 02, 2018		Soil	M18-Fe08706		X							
37	TP13_0.2-0.3	Feb 02, 2018		Soil	M18-Fe08707		X							
38	QA20180202-02	Feb 02, 2018		Soil	M18-Fe08708		X							
39	QA20180202-04	Feb 02, 2018		Soil	M18-Fe08709		X							
40	QA20180205-01	Feb 05, 2018		Soil	M18-Fe08710		X							
41	TS	Feb 05, 2018		Water	M18-Fe08711							X		
42	TB	Feb 05, 2018		Water	M18-Fe08712							X		

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Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail	Asbestos - WA guidelines	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271		X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217	X								
Brisbane Laboratory - NATA Site # 20794									
Perth Laboratory - NATA Site # 23736									
Test Counts	15	25	15	3	3	15	14	15	12

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	115			70-130	Pass	
Toluene	%	124			70-130	Pass	
Ethylbenzene	%	115			70-130	Pass	
m&p-Xylenes	%	118			70-130	Pass	
Xylenes - Total	%	129			70-130	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Qualifier Codes/Comments

Code	Description
R20	This sample is a Trip Spike and therefore all results are reported as a percentage

Authorised By

Nibha Vaidya	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)



Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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S84142

12

018916

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: S43340	LABORATORY BATCH NO.:
PROJECT NAME: Lights Road	SAMPLERS:
DATE NEEDED BY: STD turn.	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) klin2.....@jbsg.com.au; (3) ASharp.....@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	11 Metals	TRH	BTEX	PAHs	Asbestos	OCP/PCB	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
TP13 0.0-0.1	Soil	02/02				X	X	X	X	X	X			
0.2-0.3	↓													
0.5-0.6														
TP14_0.0-0.1 ACM	material									X				
TP15 0.0-0.1	Soil					X	X	X	X	X				
0.2-0.3														
TP16 0.0-0.1						X			X	X				
0.2-0.3														
TP17 0.0-0.1						X	X	X	X					
0.2-0.3														
TP18 0.0-0.1						X	X	X	X	X	X			
0.2-0.3														
TP19 0.0-0.1						X			X	X				
0.2-0.3														
TP20 0.0-0.1						X	X	X	X	X				
0.2-0.3														
TP21 0.0-0.1						X	X	X	X	X	X			
0.2-0.3														
TP22 0.0-0.1	↓					X			X	X				

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE: 04/02/18 5:17PM	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF: JBS&G	TRANSPORT CO.	OF: Eurofins Mgt.	COOLER TEMP ..... deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE:	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF:	TRANSPORT CO	OF:	COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 - Chain of Custody - Generic

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018917

CHAIN OF CUSTODY

2/2

JBS&G

PROJECT NO.: S43 40 | LABORATORY BATCH NO.:

PROJECT NAME: Links Road | SAMPLERS:

DATE NEEDED BY: STD TAT | QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) ...@jbsg.com.au; (3) ...@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H.Metals	TRH	BTEX	PAHs	Asbestos	ccP /FCB	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
TP22 0.2-0.3	soil	02/02		Jar + Bag + ice		X			X	X				
ETSP04	↓	↓		↓		X	X	X	X	X				
ETSP07														
DS-01						X	X	X	X					
QA20180202-01						X	X	X	X	X				
QC20180202-01						Please forward to Envirolab								
TS	water			Vials + ice				X						
TB	↓	↓		↓				X						

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: Lauri Sup DATE: 02/02/18 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: Jacob. w DATE: 02/02/18 5:17PM OF: Envirolab mgr.	COOLER SEAL – Yes..... No ..... Intact ..... Broken ..... COOLER TEMP ..... deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes..... No ..... Intact ..... Broken ..... COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

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Melbourne
3-5 Kingston Town Close
Oakleigh Vic 3166
Phone : +61 3 8564 5000
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Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
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Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name: **JBS & G Australia (NSW) P/L**

Contact name: Katie Linz
Project name: LINKS RD
Project ID: 54340
COC number: Not provided
Turn around time: 5 Day
Date/Time received: Feb 2, 2018 3:23 PM
Eurofins | mgt reference: **584142**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 9.1 degrees Celsius.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☑ Sample containers for volatile analysis received with zero headspace.

☑ Split sample sent to requested external lab.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Notes

Samples TS and TB not received, Analysis cancelled, DS01 Asbestos bag not received, AsbestosWA analysis cancelled.

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8400 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Katie Linz - klinz@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L

Certificate of Analysis

Accredited for compliance with ISO/IEC 17025–Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention:	Katie Linz
Report	584142-AID
Project Name	LINKS RD
Project ID	54340
Received Date	Feb 02, 2018
Date Reported	Feb 14, 2018

Methodology:

Asbestos Fibre Identification	Conducted in accordance with the Australian Standard AS 4964 – 2004: Method for the Qualitative Identification of Asbestos in Bulk Samples and in-house Method LTM-ASB-8020 by polarised light microscopy (PLM) and dispersion staining (DS) techniques. *NOTE: Positive Trace Analysis results indicate the sample contains detectable respirable fibres.*
Unknown Mineral Fibres	Mineral fibres of unknown type, as determined by PLM with DS, may require another analytical technique, such as Electron Microscopy, to confirm unequivocal identity. *NOTE: While Actinolite, Anthophyllite and Tremolite asbestos may be detected by PLM with DS, due to variability in the optical properties of these materials, AS4964 requires that these are reported as UMF unless confirmed by an independent technique.*
Subsampling Soil Samples	The whole sample submitted is first dried and then passed through a 10mm sieve followed by a 2mm sieve. All fibrous matter greater than 10mm, greater than 2mm as well as the material passing through the 2mm sieve are retained and analysed for the presence of asbestos. If the sub 2mm fraction is greater than approximately 30 to 60g then a sub-sampling routine based on ISO 3082:2009(E) is employed. *NOTE: Depending on the nature and size of the soil sample, the sub-2 mm residue material may need to be sub-sampled for trace analysis, in accordance with AS 4964-2004.*
Bonded asbestos-containing material (ACM)	The material is first examined and any fibres isolated for identification by PLM and DS. Where required, interfering matrices may be removed by disintegration using a range of heat, chemical or physical treatments, possibly in combination.The resultant material is then further examined in accordance with AS 4964 - 2004. *NOTE: Even after disintegration it may be difficult to detect the presence of asbestos in some asbestos-containing bulk materials using PLM and DS. This is due to the low grade or small length or diameter of the asbestos fibres present in the material, or to the fact that very fine fibres have been distributed intimately throughout the materials. Vinyl/asbestos floor tiles, some asbestos-containing sealants and mastics, asbestos-containing epoxy resins and some ore samples are examples of these types of material, which are difficult to analyse.*
Limit of Reporting	The performance limitation of the AS4964 method for inhomogeneous samples is around 0.1 g/kg (0.01% (w/w)). Where no asbestos is found by PLM and DS, including Trace Analysis where required, this is considered to be at the nominal reporting limit of 0.01 % (w / w).The examination of large sample sizes(500 mL is recommended) may improve the likelihood of identifying ACM in the > 2mm fraction.The NEPM screening level of 0.001 % (w / w) asbestos in soil for FA(friable asbestos) and AF(asbestos fines) then applies where they are able to be quantified by gravimetric procedures.This quantitative screening is not generally applicable to FF(free fibres) and results of Trace Analysis are referred. *NOTE: NATA News March 2014, p.7, states in relation to AS4964: "This is a qualitative method with a nominal reporting limit of 0.01%" and that currently in Australia "there is no validated method available for the quantification of asbestos". Accordingly, NATA Accreditation does not cover the performance of this service (indicated with an asterisk).* *This report is consistent with the analytical procedures and reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, 2013 (as amended) and the Western Australia Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia, 2009, including supporting document Recommended Procedures for Laboratory Analysis of Asbestos in Soil, June 2011.*

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Version: 1, Version Date: 26/11/2018

Project Name LINKS RD
Project ID 54340
Date Sampled Feb 01, 2018 to Feb 02, 2018
Report 584142-AID

Client Sample ID	Eurofins | mgt Sample No.	Date Sampled	Sample Description	Result
TP14-0.0-0.1	18-Fe02815	Feb 02, 2018	Approximate Sample 987g Sample consisted of: Brown coarse grain soil and rocks	FA: Chrysotile, amosite and crocidolite asbestos detected in weathered fibre cement fragments. Approximate raw weight of FA = 0.0074g Estimated asbestos content in FA = 0.0030g* Total estimated asbestos concentration in FA = 0.00030% w/w* No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP15-0.0-0.1	18-Fe02818	Feb 02, 2018	Approximate Sample 764g Sample consisted of: Brown coarse grain soil, rocks and organic debris	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP16-0.0-0.1	18-Fe02820	Feb 02, 2018	Approximate Sample 778g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP17-0.0-0.1	18-Fe02822	Feb 02, 2018	Approximate Sample 875g Sample consisted of: Brown coarse grain soil, rocks and organic debris	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP18-0.0-0.1	18-Fe02824	Feb 02, 2018	Approximate Sample 750g Sample consisted of: Brown coarse grain soil, rocks and organic debris	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP19-0.0-0.1	18-Fe02826	Feb 02, 2018	Approximate Sample 926g Sample consisted of: Brown coarse grain soil, rocks and organic debris	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP20-0.0-0.1	18-Fe02828	Feb 02, 2018	Approximate Sample 842g Sample consisted of: Brown coarse grain soil, rocks and organic debris	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP21-0.0-0.1	18-Fe02830	Feb 02, 2018	Approximate Sample 773g Sample consisted of: Brown coarse grain soil, rocks and organic debris	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Client Sample ID	Eurofins | mgt Sample No.	Date Sampled	Sample Description	Result
TP22-0.0-0.1	18-Fe02832	Feb 02, 2018	Approximate Sample 740g Sample consisted of: Brown coarse grain soil, rocks and organic debris	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP22-0.2-0.3	18-Fe02833	Feb 02, 2018	Approximate Sample 867g Sample consisted of: Brown coarse grain soil and rocks	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
FTSP04	18-Fe02834	Feb 02, 2018	Approximate Sample 900g Sample consisted of: Brown coarse grain soil, rocks and organic debris	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
QA20180201-01	18-Fe02838	Feb 02, 2018	Approximate Sample 726g Sample consisted of: Brown coarse grain soil, rocks and organic debris	No asbestos detected at the reporting limit of 0.001% w/w.* Organic fibre detected. No respirable fibres detected.
TP14-0.0-0.1 ACM	18-Fe03620	Feb 01, 2018	Approximate Sample 63g / 120x70x10mm Sample consisted of: Grey compressed fibre cement material	Chrysotile, amosite and crocidolite asbestos detected.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Asbestos - LTM-ASB-8020	Sydney	Feb 12, 2018	Indefinite
Asbestos - LTM-ASB-8020	Sydney	Feb 12, 2018	Indefinite

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ABN – 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

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Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
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1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
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Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: LINKS RD
Project ID: 54340

Order No.:
Report #: 584142
Phone: 02 8245 0300
Fax:

Received: Feb 2, 2018 3:23 PM
Due: Feb 14, 2018
Priority: 5 Day
Contact Name: Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	CANCELLED	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271									X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X	X								
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
External Laboratory																
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**											
1	TP14-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02815	X				X	X	X	X	X	X	X
2	TP14-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02816				X							
3	TP14-0.5-0.6	Feb 02, 2018		Soil	S18-Fe02817				X							
4	TP15-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02818	X				X			X	X	X	X
5	TP15-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02819				X							
6	TP16-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02820	X				X			X		X	
7	TP16-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02821				X							
8	TP17-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02822	X				X	X	X	X	X	X	X
9	TP17-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02823				X							

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Melbourne
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Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	CANCELLED	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271									X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X	X								
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
10	TP18-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02824	X				X	X	X	X	X	X	X
11	TP18-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02825				X							
12	TP19-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02826	X				X			X		X	
13	TP19-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02827				X							
14	TP20-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02828	X				X			X	X	X	X
15	TP20-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02829				X							
16	TP21-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02830	X				X	X	X	X	X	X	X
17	TP21-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02831				X							
18	TP22-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02832	X				X			X		X	
19	TP22-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02833	X				X			X		X	
20	FTSP04	Feb 02, 2018		Soil	S18-Fe02834	X				X			X	X	X	X
21	FTSP06	Feb 02, 2018		Soil	S18-Fe02835				X							

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Version: 1, Version Date: 26/11/2018

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ABN – 50 005 085 521
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Melbourne
3-5 Kingston Town Close
Oakleigh VIC 3166
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Contact Name: Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	CANCELLED	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271									X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X	X								
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
22	FTSP07	Feb 02, 2018		Soil	S18-Fe02836				X							
23	DS01	Feb 02, 2018		Soil	S18-Fe02837					X			X	X	X	X
24	QA20180201-01	Feb 02, 2018		Soil	S18-Fe02838	X				X	X	X	X	X	X	X
25	TP14-0.0-0.1 ACM	Feb 01, 2018		Building Materials	S18-Fe03620		X									
26	TS	Feb 02, 2018		Water	S18-Fe11286			X								
27	TB	Feb 02, 2018		Water	S18-Fe11287			X								
Test Counts						12	1	2	11	13	5	5	13	9	13	9

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Internal Quality Control Review and Glossary

General

1. QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Samples were analysed on an 'as received' basis.
4. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

Units

% w/w: weight for weight basis	grams per kilogram
Filter loading:	fibres/100 graticule areas
Reported Concentration:	fibres/mL
Flowrate:	L/min

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis
LOR	Limit of Reporting
COC	Chain of Custody
SRA	Sample Receipt Advice
ISO	International Standards Organisation
AS	Australian Standards
WA DOH	Western Australia Department of Health
NOHSC	National Occupational Health and Safety Commission
ACM	Bonded asbestos-containing material means any material containing more than 1% asbestos and comprises asbestos-containing-material which is in sound condition, although possibly broken or fragmented, and where the asbestos is bound in a matrix such as cement or resin. Common examples of ACM include but are not limited to: pipe and boiler insulation, sprayed-on fireproofing, troweled-on acoustical plaster, floor tile and mastic, floor linoleum, transite shingles, roofing materials, wall and ceiling plaster, ceiling tiles, and gasket materials. This term is restricted to material that cannot pass a 7 mm x 7 mm sieve. This sieve size is selected because it approximates the thickness of common asbestos cement sheeting and for fragments to be smaller than this would imply a high degree of damage and hence potential for fibre release.
FA	FA comprises friable asbestos material and includes severely weathered cement sheet, insulation products and woven asbestos material. This type of friable asbestos is defined here as asbestos material that is in a degraded condition such that it can be broken or crumbled by hand pressure. This material is typically unbonded or was previously bonded and is now significantly degraded (crumbling).
PACM	Presumed Asbestos-Containing Material means thermal system insulation and surfacing material found in buildings, vessels, and vessel sections constructed no later than 1980 that are assumed to contain greater than one percent asbestos but have not been sampled or analyzed to verify or negate the presence of asbestos.
AF	Asbestos fines (AF) are defined as free fibres, or fibre bundles, smaller than 7mm. It is the free fibres which present the greatest risk to human health, although very small fibres (< 5 microns in length) are not considered to be such a risk. AF also includes small fragments of bonded ACM that pass through a 7 mm x 7 mm sieve. (Note that for bonded ACM fragments to pass through a 7 mm x 7 mm sieve implies a substatntial degree of damage which increases the potential for fibre release.)
AC	Asbestos cement means a mixture of cement and asbestos fibres (typically 90:10 ratios).

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Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Qualifier Codes/Comments

Code	Description
N/A	Not applicable

Asbestos Counter/Identifier:

Laxman Dias	Senior Analyst-Asbestos (NSW)

Authorised by:

Sayeed Abu	Senior Analyst-Asbestos (NSW)



Glenn Jackson
National Operations Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

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Certificate of Analysis

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Katie Linz**

Report **584142-S**
Project name LINKS RD
Project ID 54340
Received Date Feb 02, 2018

Client Sample ID			**TP14-0.0-0.1**	**TP15-0.0-0.1**	**TP16-0.0-0.1**	**TP17-0.0-0.1**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S18-Fe02815**	**S18-Fe02818**	**S18-Fe02820**	**S18-Fe02822**
Date Sampled			**Feb 02, 2018**	**Feb 02, 2018**	**Feb 02, 2018**	**Feb 02, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	-	< 20
TRH C10-C14	20	mg/kg	32	< 20	-	27
TRH C15-C28	50	mg/kg	1900	370	-	660
TRH C29-C36	50	mg/kg	930	350	-	170
TRH C10-36 (Total)	50	mg/kg	2862	720	-	857
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	-	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	-	< 0.3
4-Bromofluorobenzene (surr.)	1	%	86	92	-	92
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	-	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	-	< 20
TRH >C10-C16	50	mg/kg	93	< 50	-	62
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	93	< 50	-	62
TRH >C16-C34	100	mg/kg	2300	630	-	670
TRH >C34-C40	100	mg/kg	550	120	-	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	60	1.9	1.7	14
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	60	2.2	1.9	14
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	60	2.4	2.2	14
Acenaphthene	0.5	mg/kg	6.4	< 0.5	< 0.5	0.8
Acenaphthylene	0.5	mg/kg	3.1	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	26	0.6	< 0.5	3.6
Benz(a)anthracene	0.5	mg/kg	28	1.2	0.9	8.0
Benzo(a)pyrene	0.5	mg/kg	39	1.5	1.3	9.6
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	24	1.1	1.1	7.9
Benzo(g.h.i)perylene	0.5	mg/kg	35	< 0.5	< 0.5	6.8
Benzo(k)fluoranthene	0.5	mg/kg	28	1.0	0.9	4.9
Chrysene	0.5	mg/kg	38	1.2	1.0	8.0
Dibenz(a.h)anthracene	0.5	mg/kg	9.3	< 0.5	< 0.5	1.7

Client Sample ID			TP14-0.0-0.1	TP15-0.0-0.1	TP16-0.0-0.1	TP17-0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02815	S18-Fe02818	S18-Fe02820	S18-Fe02822
Date Sampled			Feb 02, 2018	Feb 02, 2018	Feb 02, 2018	Feb 02, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Fluoranthene	0.5	mg/kg	130	3.8	3.0	35
Fluorene	0.5	mg/kg	7.9	< 0.5	< 0.5	2.4
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	30	0.8	0.8	5.5
Naphthalene	0.5	mg/kg	3.2	< 0.5	< 0.5	1.0
Phenanthrene	0.5	mg/kg	83	2.9	1.7	26
Pyrene	0.5	mg/kg	120	3.6	2.9	32
Total PAH*	0.5	mg/kg	610.9	17.7	13.6	153.2
2-Fluorobiphenyl (surr.)	1	%	105	74	82	60
p-Terphenyl-d14 (surr.)	1	%	91	70	85	69
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	-	-	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05	-	-	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05	-	-	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05	-	-	< 0.05
a-BHC	0.05	mg/kg	< 0.05	-	-	< 0.05
Aldrin	0.05	mg/kg	< 0.05	-	-	< 0.05
b-BHC	0.05	mg/kg	< 0.05	-	-	< 0.05
d-BHC	0.05	mg/kg	< 0.05	-	-	< 0.05
Dieldrin	0.05	mg/kg	< 0.05	-	-	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05	-	-	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05	-	-	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	-	< 0.05
Endrin	0.05	mg/kg	< 0.05	-	-	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05	-	-	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05	-	-	< 0.05
g-BHC (Lindane)	0.05	mg/kg	< 0.05	-	-	< 0.05
Heptachlor	0.05	mg/kg	< 0.05	-	-	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	-	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	-	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05	-	-	< 0.05
Toxaphene	1	mg/kg	< 1	-	-	< 1
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	-	-	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	-	-	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	-	-	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	-	-	< 0.1
Dibutylchlorendate (surr.)	1	%	87	-	-	123
Tetrachloro-m-xylene (surr.)	1	%	68	-	-	92
Polychlorinated Biphenyls						
Aroclor-1016	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1221	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1232	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1242	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1248	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1254	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1260	0.1	mg/kg	< 0.1	-	-	< 0.1
Total PCB*	0.1	mg/kg	< 0.1	-	-	< 0.1
Dibutylchlorendate (surr.)	1	%	87	-	-	123
Tetrachloro-m-xylene (surr.)	1	%	68	-	-	92

Client Sample ID			TP14-0.0-0.1	TP15-0.0-0.1	TP16-0.0-0.1	TP17-0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02815	S18-Fe02818	S18-Fe02820	S18-Fe02822
Date Sampled			Feb 02, 2018	Feb 02, 2018	Feb 02, 2018	Feb 02, 2018
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	2	mg/kg	11	5.2	5.8	8.7
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	31	15	15	28
Copper	5	mg/kg	17	14	10.0	13
Lead	5	mg/kg	23	38	34	40
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	7.0	5.9	6.5	5.4
Zinc	5	mg/kg	31	67	37	34
% Moisture	1	%	3.9	7.6	5.8	4.2

Client Sample ID			TP18-0.0-0.1	TP19-0.0-0.1	TP20-0.0-0.1	TP21-0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02824	S18-Fe02826	S18-Fe02828	S18-Fe02830
Date Sampled			Feb 02, 2018	Feb 02, 2018	Feb 02, 2018	Feb 02, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	-	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	-	35	< 20
TRH C15-C28	50	mg/kg	440	-	2600	59
TRH C29-C36	50	mg/kg	290	-	1300	87
TRH C10-36 (Total)	50	mg/kg	730	-	3935	146
BTEX						
Benzene	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	-	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	-	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	81	-	95	66
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	-	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	-	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	-	100	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	-	100	< 50
TRH >C16-C34	100	mg/kg	590	-	3200	110
TRH >C34-C40	100	mg/kg	180	-	840	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	25	18	73	1.9
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	25	18	73	2.1
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	25	18	73	2.4
Acenaphthene	0.5	mg/kg	1.1	0.9	7.5	< 0.5
Acenaphthylene	0.5	mg/kg	0.8	0.5	2.9	< 0.5
Anthracene	0.5	mg/kg	4.2	3.1	19	< 0.5
Benz(a)anthracene	0.5	mg/kg	9.8	9.0	35	1.0
Benzo(a)pyrene	0.5	mg/kg	18	12	47	1.4
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	10	9.9	41	1.3

Client Sample ID			TP18-0.0-0.1	TP19-0.0-0.1	TP20-0.0-0.1	TP21-0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02824	S18-Fe02826	S18-Fe02828	S18-Fe02830
Date Sampled			Feb 02, 2018	Feb 02, 2018	Feb 02, 2018	Feb 02, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Benzo(g.h.i)perylene	0.5	mg/kg	3.5	2.5	39	1.0
Benzo(k)fluoranthene	0.5	mg/kg	9.4	7.2	34	1.2
Chrysene	0.5	mg/kg	11	10	37	1.2
Dibenz(a.h)anthracene	0.5	mg/kg	3.3	2.3	11	< 0.5
Fluoranthene	0.5	mg/kg	28	34	170	3.0
Fluorene	0.5	mg/kg	1.8	1.4	9.7	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	11	7.5	35	0.9
Naphthalene	0.5	mg/kg	0.6	< 0.5	2.6	< 0.5
Phenanthrene	0.5	mg/kg	24	20	98	1.2
Pyrene	0.5	mg/kg	26	31	150	3.1
Total PAH*	0.5	mg/kg	162.5	151.3	738.7	15.3
2-Fluorobiphenyl (surr.)	1	%	89	92	89	79
p-Terphenyl-d14 (surr.)	1	%	83	102	95	95
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	-	-	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05	-	-	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05	-	-	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05	-	-	< 0.05
a-BHC	0.05	mg/kg	< 0.05	-	-	< 0.05
Aldrin	0.05	mg/kg	< 0.05	-	-	< 0.05
b-BHC	0.05	mg/kg	< 0.05	-	-	< 0.05
d-BHC	0.05	mg/kg	< 0.05	-	-	< 0.05
Dieldrin	0.05	mg/kg	< 0.05	-	-	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05	-	-	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05	-	-	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	-	< 0.05
Endrin	0.05	mg/kg	< 0.05	-	-	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05	-	-	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05	-	-	< 0.05
g-BHC (Lindane)	0.05	mg/kg	< 0.05	-	-	< 0.05
Heptachlor	0.05	mg/kg	< 0.05	-	-	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	-	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	-	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05	-	-	< 0.05
Toxaphene	1	mg/kg	< 1	-	-	< 1
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	-	-	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	-	-	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	-	-	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	-	-	< 0.1
Dibutylchlorendate (surr.)	1	%	106	-	-	95
Tetrachloro-m-xylene (surr.)	1	%	87	-	-	74
Polychlorinated Biphenyls						
Aroclor-1016	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1221	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1232	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1242	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1248	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1254	0.1	mg/kg	< 0.1	-	-	< 0.1
Aroclor-1260	0.1	mg/kg	< 0.1	-	-	< 0.1

Client Sample ID			TP18-0.0-0.1	TP19-0.0-0.1	TP20-0.0-0.1	TP21-0.0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02824	S18-Fe02826	S18-Fe02828	S18-Fe02830
Date Sampled			Feb 02, 2018	Feb 02, 2018	Feb 02, 2018	Feb 02, 2018
Test/Reference	LOR	Unit				
Polychlorinated Biphenyls						
Total PCB*	0.1	mg/kg	< 0.1	-	-	< 0.1
Dibutylchlorendate (surr.)	1	%	106	-	-	95
Tetrachloro-m-xylene (surr.)	1	%	87	-	-	74
Heavy Metals						
Arsenic	2	mg/kg	12	8.9	9.0	7.5
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	0.5
Chromium	5	mg/kg	35	24	27	28
Copper	5	mg/kg	25	19	26	33
Lead	5	mg/kg	83	54	83	140
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	9.7	6.0	9.2	11
Zinc	5	mg/kg	130	47	76	130
% Moisture	1	%	8.6	4.3	5.2	8.5

Client Sample ID			TP22-0.0-0.1	TP22-0.2-0.3	FTSP04	DS01
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins | mgt Sample No.			S18-Fe02832	S18-Fe02833	S18-Fe02834	S18-Fe02837
Date Sampled			Feb 02, 2018	Feb 02, 2018	Feb 02, 2018	Feb 02, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	-	-	< 20	< 20
TRH C10-C14	20	mg/kg	-	-	< 20	560
TRH C15-C28	50	mg/kg	-	-	< 50	8400
TRH C29-C36	50	mg/kg	-	-	< 50	130
TRH C10-36 (Total)	50	mg/kg	-	-	< 50	9090
BTEX						
Benzene	0.1	mg/kg	-	-	< 0.1	< 0.1
Toluene	0.1	mg/kg	-	-	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	-	-	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	-	-	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	-	-	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	-	-	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	-	-	93	102
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	-	-	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	-	-	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	-	-	< 20	< 20
TRH >C10-C16	50	mg/kg	-	-	< 50	1900
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	-	-	< 50	1900
TRH >C16-C34	100	mg/kg	-	-	< 100	6300
TRH >C34-C40	100	mg/kg	-	-	< 100	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	0.6	0.6	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	1.2	1.2	1.2
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5

Client Sample ID			TP22-0.0-0.1	TP22-0.2-0.3	FTSP04	DS01
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S18-Fe02832**	**S18-Fe02833**	**S18-Fe02834**	**S18-Fe02837**
Date Sampled			**Feb 02, 2018**	**Feb 02, 2018**	**Feb 02, 2018**	**Feb 02, 2018**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Chrysene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Fluoranthene	0.5	mg/kg	0.7	< 0.5	< 0.5	< 0.5
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Pyrene	0.5	mg/kg	0.7	< 0.5	< 0.5	0.8
Total PAH*	0.5	mg/kg	1.4	< 0.5	< 0.5	0.8
2-Fluorobiphenyl (surr.)	1	%	82	77	88	61
p-Terphenyl-d14 (surr.)	1	%	103	102	93	68
Heavy Metals						
Arsenic	2	mg/kg	6.7	3.5	4.8	6.9
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	24	15	15	30
Copper	5	mg/kg	20	5.9	24	28
Lead	5	mg/kg	85	12	33	100
Mercury	0.1	mg/kg	< 0.1	< 0.1	0.2	< 0.1
Nickel	5	mg/kg	7.9	< 5	11	13
Zinc	5	mg/kg	65	7.6	90	130
% Moisture	1	%	4.1	2.7	1.9	3.7

Client Sample ID			QA20180201-01
Sample Matrix			**Soil**
Eurofins | mgt Sample No.			**S18-Fe02838**
Date Sampled			**Feb 02, 2018**
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons - 1999 NEPM Fractions			
TRH C6-C9	20	mg/kg	< 20
TRH C10-C14	20	mg/kg	< 20
TRH C15-C28	50	mg/kg	< 50
TRH C29-C36	50	mg/kg	< 50
TRH C10-36 (Total)	50	mg/kg	< 50
BTEX			
Benzene	0.1	mg/kg	< 0.1
Toluene	0.1	mg/kg	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2
o-Xylene	0.1	mg/kg	< 0.1

Client Sample ID			QA20180201-01
Sample Matrix			**Soil**
Eurofins | mgt Sample No.			**S18-Fe02838**
Date Sampled			**Feb 02, 2018**
Test/Reference	LOR	Unit	
BTEX			
Xylenes - Total	0.3	mg/kg	< 0.3
4-Bromofluorobenzene (surr.)	1	%	95
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
Naphthalene[N02]	0.5	mg/kg	< 0.5
TRH C6-C10	20	mg/kg	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20
TRH >C10-C16	50	mg/kg	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50
TRH >C16-C34	100	mg/kg	< 100
TRH >C34-C40	100	mg/kg	< 100
Polycyclic Aromatic Hydrocarbons			
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2
Acenaphthene	0.5	mg/kg	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5
Anthracene	0.5	mg/kg	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5
Chrysene	0.5	mg/kg	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5
Fluorene	0.5	mg/kg	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5
Naphthalene	0.5	mg/kg	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5
Pyrene	0.5	mg/kg	< 0.5
Total PAH*	0.5	mg/kg	< 0.5
2-Fluorobiphenyl (surr.)	1	%	82
p-Terphenyl-d14 (surr.)	1	%	87
Organochlorine Pesticides			
Chlordanes - Total	0.1	mg/kg	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05
a-BHC	0.05	mg/kg	< 0.05
Aldrin	0.05	mg/kg	< 0.05
b-BHC	0.05	mg/kg	< 0.05
d-BHC	0.05	mg/kg	< 0.05
Dieldrin	0.05	mg/kg	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05
Endrin	0.05	mg/kg	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05

Client Sample ID			QA20180201-01
Sample Matrix			**Soil**
Eurofins | mgt Sample No.			**S18-Fe02838**
Date Sampled			**Feb 02, 2018**
Test/Reference	LOR	Unit	
Organochlorine Pesticides			
g-BHC (Lindane)	0.05	mg/kg	< 0.05
Heptachlor	0.05	mg/kg	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05
Toxaphene	1	mg/kg	< 1
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1
Dibutylchlorendate (surr.)	1	%	94
Tetrachloro-m-xylene (surr.)	1	%	77
Polychlorinated Biphenyls			
Aroclor-1016	0.1	mg/kg	< 0.1
Aroclor-1221	0.1	mg/kg	< 0.1
Aroclor-1232	0.1	mg/kg	< 0.1
Aroclor-1242	0.1	mg/kg	< 0.1
Aroclor-1248	0.1	mg/kg	< 0.1
Aroclor-1254	0.1	mg/kg	< 0.1
Aroclor-1260	0.1	mg/kg	< 0.1
Total PCB*	0.1	mg/kg	< 0.1
Dibutylchlorendate (surr.)	1	%	94
Tetrachloro-m-xylene (surr.)	1	%	77
Heavy Metals			
Arsenic	2	mg/kg	7.6
Cadmium	0.4	mg/kg	0.5
Chromium	5	mg/kg	19
Copper	5	mg/kg	30
Lead	5	mg/kg	69
Mercury	0.1	mg/kg	< 0.1
Nickel	5	mg/kg	14
Zinc	5	mg/kg	270
% Moisture	1	%	3.6

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Feb 12, 2018	14 Day
- Method: LTM-ORG-2010 TRH C6-C36			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Feb 12, 2018	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Feb 12, 2018	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
BTEX	Melbourne	Feb 12, 2018	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Polycyclic Aromatic Hydrocarbons	Melbourne	Feb 12, 2018	14 Day
- Method: LTM-ORG-2130 PAH and Phenols in Soils by GCMS			
Organochlorine Pesticides	Melbourne	Feb 12, 2018	14 Day
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water			
Polychlorinated Biphenyls	Melbourne	Feb 12, 2018	28 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water			
Metals M8	Melbourne	Feb 12, 2018	28 Days
- Method: LTM-MET-3030 by ICP-OES (hydride ICP-OES for Mercury)			
% Moisture	Melbourne	Feb 09, 2018	14 Day
- Method: LTM-GEN-7080 Moisture			

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ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: LINKS RD
Project ID: 54340

Order No.:
Report #: 584142
Phone: 02 8245 0300
Fax:

Received: Feb 2, 2018 3:23 PM
Due: Feb 14, 2018
Priority: 5 Day
Contact Name: Katie Linz

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	CANCELLED	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271									X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X	X								
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
External Laboratory																
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**											
1	TP14-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02815	X				X	X	X	X	X	X	X
2	TP14-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02816				X							
3	TP14-0.5-0.6	Feb 02, 2018		Soil	S18-Fe02817				X							
4	TP15-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02818	X				X			X	X	X	X
5	TP15-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02819				X							
6	TP16-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02820	X				X			X		X	
7	TP16-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02821				X							
8	TP17-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02822	X				X	X	X	X	X	X	X
9	TP17-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02823				X							

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ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**	**Received:** Feb 2, 2018 3:23 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:** 584142 **Phone:** 02 8245 0300 **Fax:**	**Due:** Feb 14, 2018 **Priority:** 5 Day **Contact Name:** Katie Linz
Project Name:	LINKS RD		
Project ID:	54340		

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	CANCELLED	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271									X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X	X								
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
10	TP18-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02824	X				X	X	X	X	X	X	X
11	TP18-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02825				X							
12	TP19-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02826	X				X			X		X	
13	TP19-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02827				X							
14	TP20-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02828	X				X			X	X	X	X
15	TP20-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02829				X							
16	TP21-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02830	X				X	X	X	X	X	X	X
17	TP21-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02831				X							
18	TP22-0.0-0.1	Feb 02, 2018		Soil	S18-Fe02832	X				X			X		X	
19	TP22-0.2-0.3	Feb 02, 2018		Soil	S18-Fe02833	X				X			X		X	
20	FTSP04	Feb 02, 2018		Soil	S18-Fe02834	X				X			X	X	X	X
21	FTSP06	Feb 02, 2018		Soil	S18-Fe02835				X							

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e.mail : EnviroSales@eurofins.com
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Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
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Unit F3, Building F
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Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Feb 2, 2018 3:23 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	584142	**Due:**	Feb 14, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Katie Linz
Project Name:	LINKS RD				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Asbestos - WA guidelines	Asbestos Absence /Presence	CANCELLED	HOLD	Polycyclic Aromatic Hydrocarbons	Organochlorine Pesticides	Polychlorinated Biphenyls	Metals M8	BTEX	Moisture Set	Total Recoverable Hydrocarbons
Melbourne Laboratory - NATA Site # 1254 & 14271									X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X	X	X								
Brisbane Laboratory - NATA Site # 20794																
Perth Laboratory - NATA Site # 23736																
22	FTSP07	Feb 02, 2018		Soil	S18-Fe02836				X							
23	DS01	Feb 02, 2018		Soil	S18-Fe02837					X			X	X	X	X
24	QA20180201-01	Feb 02, 2018		Soil	S18-Fe02838	X				X	X	X	X	X	X	X
25	TP14-0.0-0.1 ACM	Feb 01, 2018		Building Materials	S18-Fe03620		X									
26	TS	Feb 02, 2018		Water	S18-Fe11286			X								
27	TB	Feb 02, 2018		Water	S18-Fe11287			X								
Test Counts						12	1	2	11	13	5	5	13	9	13	9

Document Set ID: 8477747
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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Organochlorine Pesticides							
Chlordanes - Total	mg/kg	< 0.1			0.1	Pass	
4.4'-DDD	mg/kg	< 0.05			0.05	Pass	
4.4'-DDE	mg/kg	< 0.05			0.05	Pass	
4.4'-DDT	mg/kg	< 0.05			0.05	Pass	
a-BHC	mg/kg	< 0.05			0.05	Pass	
Aldrin	mg/kg	< 0.05			0.05	Pass	
b-BHC	mg/kg	< 0.05			0.05	Pass	
d-BHC	mg/kg	< 0.05			0.05	Pass	
Dieldrin	mg/kg	< 0.05			0.05	Pass	
Endosulfan I	mg/kg	< 0.05			0.05	Pass	
Endosulfan II	mg/kg	< 0.05			0.05	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endosulfan sulphate	mg/kg	< 0.05			0.05	Pass	
Endrin	mg/kg	< 0.05			0.05	Pass	
Endrin aldehyde	mg/kg	< 0.05			0.05	Pass	
Endrin ketone	mg/kg	< 0.05			0.05	Pass	
g-BHC (Lindane)	mg/kg	< 0.05			0.05	Pass	
Heptachlor	mg/kg	< 0.05			0.05	Pass	
Heptachlor epoxide	mg/kg	< 0.05			0.05	Pass	
Hexachlorobenzene	mg/kg	< 0.05			0.05	Pass	
Methoxychlor	mg/kg	< 0.05			0.05	Pass	
Toxaphene	mg/kg	< 1			1	Pass	
Method Blank							
Polychlorinated Biphenyls							
Aroclor-1016	mg/kg	< 0.1			0.1	Pass	
Aroclor-1221	mg/kg	< 0.1			0.1	Pass	
Aroclor-1232	mg/kg	< 0.1			0.1	Pass	
Aroclor-1242	mg/kg	< 0.1			0.1	Pass	
Aroclor-1248	mg/kg	< 0.1			0.1	Pass	
Aroclor-1254	mg/kg	< 0.1			0.1	Pass	
Aroclor-1260	mg/kg	< 0.1			0.1	Pass	
Total PCB*	mg/kg	< 0.1			0.1	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	124			70-130	Pass	
TRH C10-C14	%	79			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	89			70-130	Pass	
Toluene	%	99			70-130	Pass	
Ethylbenzene	%	116			70-130	Pass	
m&p-Xylenes	%	119			70-130	Pass	
Xylenes - Total	%	116			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	97			70-130	Pass	
TRH C6-C10	%	117			70-130	Pass	
TRH >C10-C16	%	74			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	74			70-130	Pass	
Acenaphthylene	%	78			70-130	Pass	
Anthracene	%	79			70-130	Pass	
Benz(a)anthracene	%	88			70-130	Pass	
Benzo(a)pyrene	%	92			70-130	Pass	
Benzo(b&j)fluoranthene	%	96			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzo(g.h.i)perylene	%	74			70-130	Pass	
Benzo(k)fluoranthene	%	89			70-130	Pass	
Chrysene	%	78			70-130	Pass	
Dibenz(a.h)anthracene	%	85			70-130	Pass	
Fluoranthene	%	128			70-130	Pass	
Fluorene	%	77			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	80			70-130	Pass	
Naphthalene	%	74			70-130	Pass	
Phenanthrene	%	92			70-130	Pass	
Pyrene	%	124			70-130	Pass	
LCS - % Recovery							
Organochlorine Pesticides							
4.4'-DDD	%	98			70-130	Pass	
4.4'-DDE	%	114			70-130	Pass	
4.4'-DDT	%	99			70-130	Pass	
a-BHC	%	123			70-130	Pass	
Aldrin	%	106			70-130	Pass	
b-BHC	%	115			70-130	Pass	
d-BHC	%	121			70-130	Pass	
Dieldrin	%	110			70-130	Pass	
Endosulfan I	%	109			70-130	Pass	
Endosulfan II	%	108			70-130	Pass	
Endosulfan sulphate	%	110			70-130	Pass	
Endrin	%	107			70-130	Pass	
Endrin aldehyde	%	107			70-130	Pass	
Endrin ketone	%	113			70-130	Pass	
g-BHC (Lindane)	%	121			70-130	Pass	
Heptachlor	%	127			70-130	Pass	
Heptachlor epoxide	%	105			70-130	Pass	
Hexachlorobenzene	%	119			70-130	Pass	
Methoxychlor	%	102			70-130	Pass	
LCS - % Recovery							
Polychlorinated Biphenyls							
Aroclor-1260	%	87			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	111			80-120	Pass	
Cadmium	%	112			80-120	Pass	
Chromium	%	113			80-120	Pass	
Copper	%	108			80-120	Pass	
Lead	%	111			80-120	Pass	
Mercury	%	94			75-125	Pass	
Nickel	%	107			80-120	Pass	
Zinc	%	109			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M18-Fe12841	NCP	%	107			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	M18-Fe12841	NCP	%	78			70-130	Pass	
Toluene	M18-Fe12841	NCP	%	94			70-130	Pass	
Ethylbenzene	M18-Fe12841	NCP	%	112			70-130	Pass	
m&p-Xylenes	M18-Fe12841	NCP	%	116			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
o-Xylene	M18-Fe12841	NCP	%	110			70-130	Pass	
Xylenes - Total	M18-Fe12841	NCP	%	114			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M18-Fe12841	NCP	%	107			70-130	Pass	
TRH C6-C10	M18-Fe12841	NCP	%	105			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	M18-Fe13401	NCP	%	79			70-130	Pass	
Acenaphthylene	M18-Fe13401	NCP	%	84			70-130	Pass	
Anthracene	M18-Fe13401	NCP	%	90			70-130	Pass	
Benz(a)anthracene	M18-Fe13401	NCP	%	73			70-130	Pass	
Benzo(a)pyrene	M18-Fe13401	NCP	%	92			70-130	Pass	
Benzo(b&j)fluoranthene	M18-Fe13401	NCP	%	110			70-130	Pass	
Benzo(g.h.i)perylene	M18-Fe13401	NCP	%	72			70-130	Pass	
Benzo(k)fluoranthene	M18-Fe13401	NCP	%	103			70-130	Pass	
Chrysene	M18-Fe13401	NCP	%	76			70-130	Pass	
Dibenz(a.h)anthracene	M18-Fe13401	NCP	%	86			70-130	Pass	
Fluoranthene	M18-Fe13401	NCP	%	71			70-130	Pass	
Fluorene	M18-Fe13401	NCP	%	82			70-130	Pass	
Indeno(1.2.3-cd)pyrene	M18-Fe13401	NCP	%	80			70-130	Pass	
Naphthalene	M18-Fe13401	NCP	%	80			70-130	Pass	
Phenanthrene	M18-Fe13401	NCP	%	81			70-130	Pass	
Pyrene	M18-Fe13401	NCP	%	70			70-130	Pass	
Spike - % Recovery									
Organochlorine Pesticides				Result 1					
4.4'-DDD	S18-Fe08025	NCP	%	88			70-130	Pass	
4.4'-DDE	S18-Fe08025	NCP	%	105			70-130	Pass	
4.4'-DDT	S18-Fe08025	NCP	%	123			70-130	Pass	
a-BHC	S18-Fe08025	NCP	%	108			70-130	Pass	
Aldrin	S18-Fe08025	NCP	%	126			70-130	Pass	
b-BHC	S18-Fe08025	NCP	%	103			70-130	Pass	
d-BHC	S18-Fe08025	NCP	%	109			70-130	Pass	
Dieldrin	S18-Fe08025	NCP	%	99			70-130	Pass	
Endosulfan I	S18-Fe08025	NCP	%	95			70-130	Pass	
Endosulfan II	S18-Fe08025	NCP	%	97			70-130	Pass	
Endosulfan sulphate	S18-Fe08025	NCP	%	101			70-130	Pass	
Endrin	S18-Fe08025	NCP	%	102			70-130	Pass	
Endrin aldehyde	S18-Fe08025	NCP	%	128			70-130	Pass	
Endrin ketone	S18-Fe08025	NCP	%	100			70-130	Pass	
g-BHC (Lindane)	S18-Fe08025	NCP	%	109			70-130	Pass	
Heptachlor	S18-Fe08025	NCP	%	124			70-130	Pass	
Heptachlor epoxide	S18-Fe08025	NCP	%	129			70-130	Pass	
Hexachlorobenzene	S18-Fe08025	NCP	%	106			70-130	Pass	
Methoxychlor	S18-Fe08025	NCP	%	124			70-130	Pass	
Spike - % Recovery									
Polychlorinated Biphenyls				Result 1					
Aroclor-1260	S18-Fe08027	NCP	%	101			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	S18-Fe02816	CP	%	110			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	S18-Fe02816	CP	%	103			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S18-Fe02824	CP	%	85			75-125	Pass	
Cadmium	S18-Fe02824	CP	%	91			75-125	Pass	
Chromium	S18-Fe02824	CP	%	77			75-125	Pass	
Copper	S18-Fe02824	CP	%	85			75-125	Pass	
Lead	S18-Fe02824	CP	%	76			75-125	Pass	
Mercury	S18-Fe02824	CP	%	92			70-130	Pass	
Nickel	S18-Fe02824	CP	%	84			75-125	Pass	
Zinc	S18-Fe02824	CP	%	71			75-125	Fail	Q08
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M18-Fe12782	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	S18-Fe02815	CP	mg/kg	32	25	23	30%	Pass	
TRH C15-C28	S18-Fe02815	CP	mg/kg	1900	1400	25	30%	Pass	
TRH C29-C36	S18-Fe02815	CP	mg/kg	930	940	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M18-Fe12782	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	M18-Fe12782	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	M18-Fe12782	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	M18-Fe12782	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	M18-Fe12782	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	M18-Fe12782	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M18-Fe12782	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	M18-Fe12782	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	S18-Fe02815	CP	mg/kg	93	64	37	30%	Fail	
TRH >C16-C34	S18-Fe02815	CP	mg/kg	2300	1900	16	30%	Pass	
TRH >C34-C40	S18-Fe02815	CP	mg/kg	550	620	11	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	M18-Fe13400	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	

Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Chlordanes - Total	S18-Fe08025	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
4.4'-DDD	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDE	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDT	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-BHC	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Aldrin	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-BHC	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-BHC	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin aldehyde	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-BHC (Lindane)	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor epoxide	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	S18-Fe08025	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Toxaphene	S18-Fe08025	NCP	mg/kg	< 1	< 1	<1	30%	Pass	
Duplicate									
Polychlorinated Biphenyls				Result 1	Result 2	RPD			
Aroclor-1016	S18-Fe08025	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1221	S18-Fe08025	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1232	S18-Fe08025	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1242	S18-Fe08025	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1248	S18-Fe08025	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1254	S18-Fe08025	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1260	S18-Fe08025	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Total PCB*	S18-Fe08025	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	B18-Fe08988	NCP	%	12	12	2.0	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S18-Fe02822	CP	mg/kg	8.7	9.2	6.0	30%	Pass	
Cadmium	S18-Fe02822	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	S18-Fe02822	CP	mg/kg	28	33	19	30%	Pass	
Copper	S18-Fe02822	CP	mg/kg	13	13	3.0	30%	Pass	
Lead	S18-Fe02822	CP	mg/kg	40	43	7.0	30%	Pass	
Mercury	S18-Fe02822	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	S18-Fe02822	CP	mg/kg	5.4	6.3	15	30%	Pass	
Zinc	S18-Fe02822	CP	mg/kg	34	36	5.0	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S18-Fe02824	CP	mg/kg	12	12	2.0	30%	Pass	
Cadmium	S18-Fe02824	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	S18-Fe02824	CP	mg/kg	35	36	2.0	30%	Pass	
Copper	S18-Fe02824	CP	mg/kg	25	25	3.0	30%	Pass	
Lead	S18-Fe02824	CP	mg/kg	83	85	2.0	30%	Pass	
Mercury	S18-Fe02824	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	S18-Fe02824	CP	mg/kg	9.7	9.9	2.0	30%	Pass	
Zinc	S18-Fe02824	CP	mg/kg	130	140	3.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference

Authorised By

Nibha Vaidya	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Harry Bacalis	Senior Analyst-Volatile (VIC)
Huong Le	Senior Analyst-Inorganic (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Nibha Vaidya	Senior Analyst-Asbestos (NSW)



Glenn Jackson

National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Enviro Sample Vic

From: Nibha Vaidya
Sent: Friday, 23 February 2018 10:10 AM
To: Enviro Sample Vic
Subject: 5 DAY TAT - FW: Eurofins | mgt Test Results - Report 584142 : Site LINKS RD (54340)

Additional analysis please

Kind Regards,

Nibha Vaidya
Phone : +61 2 9900 8415
Mobile : +61 499 900 805
Email : NibhaVaidya@eurofins.com

From: Katie Linz [mailto:KLinz@jbsg.com.au]
Sent: Friday, 23 February 2018 9:20 AM
To: Asim Khan; Nibha Vaidya
Cc: Rob Sharp
Subject: RE: Eurofins | mgt Test Results - Report 584142 : Site LINKS RD (54340)

EXTERNAL EMAIL*

Hi Nibha,

Can I please request the following additional analysis on std tat.

- TCLP PAHs on sample TP14 0-0.1, TP17 0-0.1, TP20 0-0.1,
- PAHs on samples TP14 0.2-0.3, TP17 0.2-0.3 and TP20 0.2-0.3

Thanks,

Katie

Please note I am available in the office Tuesday to Friday

Fe 2815
2822
2828
} R19444.

2816 - Hold
2823 - Hold
2829 - Hold
410

Katie Linz | Senior Environmental Consultant | JBS&G
Sydney | Melbourne | Adelaide | Perth | Brisbane
Level 1, 50 Margaret St, Sydney, NSW 2000
T: 02 8245 0300 | M: 0422 913 638 | www.jbsg.com.au
Contaminated Land | Groundwater Remediation | Environmental Impact Assessment | Auditing and Compliance | Hygiene and Hazardous Materials | Due Diligence and Liability

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Sulpa Patel
23/2/18 9:20 Am

From: AsimKhan@eurofins.com [mailto:AsimKhan@eurofins.com]
Sent: Wednesday, 14 February 2018 8:52 PM

584592

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Melbourne
3-5 Kingston Town Close
Oakleigh Vic 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name: **JBS & G Australia (NSW) P/L**

Contact name: Katie Linz
Project name: LINKS RD
Project ID: 54340
COC number: Not provided
Turn around time: 5 Day
Date/Time received: Feb 23, 2018 9:20 AM
Eurofins | mgt reference: **586592**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 9.1 degrees Celsius.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☒ Split sample sent to requested external lab.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8400 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Katie Linz - klinz@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email address.

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention: **Katie Linz**

Report **586592-L**
Project name LINKS RD
Project ID 54340
Received Date Feb 23, 2018

Client Sample ID			**TP14 0-0.1**	**TP17 0-0.1**	**TP20 0-0.1**
Sample Matrix			**US Leachate**	**US Leachate**	**US Leachate**
Eurofins | mgt Sample No.			**M18-Fe30016**	**M18-Fe30017**	**M18-Fe30018**
Date Sampled			**Feb 02, 2018**	**Feb 02, 2018**	**Feb 02, 2018**
Test/Reference	LOR	Unit			
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	0.002	0.001	0.002
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	0.003	0.001	0.002
2-Fluorobiphenyl (surr.)	1	%	113	91	75
p-Terphenyl-d14 (surr.)	1	%	105	76	124
USA Leaching Procedure					
Leachate Fluid[C01]		comment	1.0	1.0	1.0
pH (initial)	0.1	pH Units	5.9	5.6	5.5
pH (Leachate fluid)	0.1	pH Units	5.0	5.0	5.0
pH (off)	0.1	pH Units	5.2	5.2	5.2
pH (USA HCl addition)	0.1	pH Units	1.6	1.7	1.6

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons	Melbourne	Feb 28, 2018	7 Day

- Method: LTM-ORG-2130 PAH and Phenols in Soils by GCMS

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eurofins | mgt

ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

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1/21 Smallwood Place
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Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Feb 23, 2018 9:20 AM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	586592	**Due:**	Mar 2, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Katie Linz
Project Name:	LINKS RD				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Polycyclic Aromatic Hydrocarbons	USA Leaching Procedure	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794								
Perth Laboratory - NATA Site # 23736								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	TP14 0-0.1	Feb 02, 2018		US Leachate	M18-Fe30016	X	X	
2	TP17 0-0.1	Feb 02, 2018		US Leachate	M18-Fe30017	X	X	
3	TP20 0-0.1	Feb 02, 2018		US Leachate	M18-Fe30018	X	X	
4	TP14 0.2-0.3	Feb 02, 2018		Soil	M18-Fe30019	X		X
5	TP17 0.2-0.3	Feb 02, 2018		Soil	M18-Fe30020	X		X
6	TP20 0.2-0.3	Feb 02, 2018		Soil	M18-Fe30021	X		X
Test Counts						6	3	3

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	M18-Fe30018	CP	%	76			70-130	Pass	
Acenaphthylene	M18-Fe30018	CP	%	107			70-130	Pass	
Anthracene	M18-Fe30018	CP	%	91			70-130	Pass	
Benz(a)anthracene	M18-Fe30018	CP	%	108			70-130	Pass	
Benzo(a)pyrene	M18-Fe30018	CP	%	84			70-130	Pass	
Benzo(b&j)fluoranthene	M18-Fe30018	CP	%	88			70-130	Pass	
Benzo(g.h.i)perylene	M18-Fe30018	CP	%	77			70-130	Pass	
Benzo(k)fluoranthene	M18-Fe30018	CP	%	83			70-130	Pass	
Chrysene	M18-Fe30018	CP	%	111			70-130	Pass	
Dibenz(a.h)anthracene	M18-Fe30018	CP	%	80			70-130	Pass	
Fluoranthene	M18-Fe30018	CP	%	96			70-130	Pass	
Fluorene	M18-Fe30018	CP	%	83			70-130	Pass	
Indeno(1.2.3-cd)pyrene	M18-Fe30018	CP	%	80			70-130	Pass	
Naphthalene	M18-Fe30018	CP	%	74			70-130	Pass	
Phenanthrene	M18-Fe30018	CP	%	94			70-130	Pass	
Pyrene	M18-Fe30018	CP	%	95			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Acenaphthylene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Anthracene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benz(a)anthracene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(a)pyrene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(b&j)fluoranthene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(g.h.i)perylene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(k)fluoranthene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chrysene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Dibenz(a.h)anthracene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluoranthene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluorene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Naphthalene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene	M18-Fe30017	CP	mg/L	0.001	0.001	27	30%	Pass	
Pyrene	M18-Fe30017	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Qualifier Codes/Comments

Code	Description
C01	Leachate Fluid Key: 1 - pH 5.0; 2 - pH 2.9; 3 - pH 9.2; 4 - Reagent (DI) water; 5 - Client sample, 6 - other
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised By

Nibha Vaidya	Analytical Services Manager
Joseph Edouard	Senior Analyst-Organic (VIC)



Glenn Jackson

National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Certificate of Analysis

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Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention: **Katie Linz**

Report **586592-S**
Project name LINKS RD
Project ID 54340
Received Date Feb 23, 2018

Client Sample ID			**TP14 0.2-0.3**	**TP17 0.2-0.3**	**TP20 0.2-0.3**
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**M18-Fe30019**	**M18-Fe30020**	**M18-Fe30021**
Date Sampled			**Feb 02, 2018**	**Feb 02, 2018**	**Feb 02, 2018**
Test/Reference	LOR	Unit			
Polycyclic Aromatic Hydrocarbons					
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	7.2	0.7	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	7.2	1.0	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	7.2	1.3	1.2
Acenaphthene	0.5	mg/kg	0.6	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	3.5	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	3.7	< 0.5	< 0.5
Benzo(a)pyrene	0.5	mg/kg	4.8	0.6	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	2.8	0.5	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	4.7	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	2.7	< 0.5	< 0.5
Chrysene	0.5	mg/kg	3.9	< 0.5	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	1.0	< 0.5	< 0.5
Fluoranthene	0.5	mg/kg	12	0.7	< 0.5
Fluorene	0.5	mg/kg	0.9	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	4.0	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	9.6	< 0.5	< 0.5
Pyrene	0.5	mg/kg	12	0.8	< 0.5
Total PAH*	0.5	mg/kg	66.2	2.6	< 0.5
2-Fluorobiphenyl (surr.)	1	%	74	74	76
p-Terphenyl-d14 (surr.)	1	%	67	74	86
% Moisture	1	%	6.5	4.6	2.7

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons	Melbourne	Feb 26, 2018	14 Day
- Method: LTM-ORG-2130 PAH and Phenols in Soils by GCMS			
% Moisture	Melbourne	Feb 26, 2018	14 Day
- Method: LTM-GEN-7080 Moisture			

eurofins | mgt

ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Feb 23, 2018 9:20 AM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	586592	**Due:**	Mar 2, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Katie Linz
Project Name:	LINKS RD				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Polycyclic Aromatic Hydrocarbons	USA Leaching Procedure	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794								
Perth Laboratory - NATA Site # 23736								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	TP14 0-0.1	Feb 02, 2018		US Leachate	M18-Fe30016	X	X	
2	TP17 0-0.1	Feb 02, 2018		US Leachate	M18-Fe30017	X	X	
3	TP20 0-0.1	Feb 02, 2018		US Leachate	M18-Fe30018	X	X	
4	TP14 0.2-0.3	Feb 02, 2018		Soil	M18-Fe30019	X		X
5	TP17 0.2-0.3	Feb 02, 2018		Soil	M18-Fe30020	X		X
6	TP20 0.2-0.3	Feb 02, 2018		Soil	M18-Fe30021	X		X
Test Counts						6	3	3

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	86			70-130	Pass	
Acenaphthylene	%	89			70-130	Pass	
Anthracene	%	118			70-130	Pass	
Benz(a)anthracene	%	73			70-130	Pass	
Benzo(a)pyrene	%	84			70-130	Pass	
Benzo(b&j)fluoranthene	%	79			70-130	Pass	
Benzo(g.h.i)perylene	%	73			70-130	Pass	
Benzo(k)fluoranthene	%	83			70-130	Pass	
Chrysene	%	117			70-130	Pass	
Dibenz(a.h)anthracene	%	75			70-130	Pass	
Fluoranthene	%	87			70-130	Pass	
Fluorene	%	94			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	78			70-130	Pass	
Naphthalene	%	82			70-130	Pass	
Phenanthrene	%	74			70-130	Pass	
Pyrene	%	89			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	M18-Fe28678	NCP	%	96			70-130	Pass	
Acenaphthylene	M18-Fe28678	NCP	%	98			70-130	Pass	
Anthracene	M18-Fe28678	NCP	%	127			70-130	Pass	
Benz(a)anthracene	M18-Fe28678	NCP	%	70			70-130	Pass	
Benzo(a)pyrene	M18-Fe28678	NCP	%	94			70-130	Pass	
Benzo(b&j)fluoranthene	M18-Fe28678	NCP	%	84			70-130	Pass	
Benzo(g.h.i)perylene	M18-Fe28678	NCP	%	78			70-130	Pass	
Benzo(k)fluoranthene	M18-Fe28678	NCP	%	92			70-130	Pass	
Chrysene	M18-Fe28678	NCP	%	127			70-130	Pass	
Dibenz(a.h)anthracene	M18-Fe28678	NCP	%	82			70-130	Pass	
Fluoranthene	M18-Fe28678	NCP	%	97			70-130	Pass	
Fluorene	M18-Fe28678	NCP	%	104			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Indeno(1.2.3-cd)pyrene	M18-Fe28678	NCP	%	98			70-130	Pass	
Naphthalene	M18-Fe28678	NCP	%	96			70-130	Pass	
Phenanthrene	M18-Fe28678	NCP	%	80			70-130	Pass	
Pyrene	M18-Fe28678	NCP	%	98			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	M18-Fe28677	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M18-Fe30007	NCP	%	14	15	10	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Qualifier Codes/Comments

Code	Description
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised By

Nibha Vaidya	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Michael Brancati	Senior Analyst-Inorganic (VIC)



Glenn Jackson

National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Enviro Sample Vic

From: Nibha Vaidya
Sent: Friday, 23 February 2018 10:11 AM
To: Enviro Sample Vic
Subject: 5 DAY TAT - FW: Eurofins | mgt Test Results - Report 582994 : Site ST MARYS PSI (54340)

Follow Up Flag: Follow up
Flag Status: Flagged

Another one please

Kind Regards,

Nibha Vaidya
Phone : +61 2 9900 8415
Mobile : +61 499 900 805
Email : NibhaVaidya@eurofins.com

From: Katie Linz [mailto:KLinz@jbsg.com.au]
Sent: Friday, 23 February 2018 9:23 AM
To: Nibha Vaidya
Cc: Rob Sharp
Subject: RE: Eurofins | mgt Test Results - Report 582994 : Site ST MARYS PSI (54340)

EXTERNAL EMAIL*

ds. 1/2 Q806 HOLD

Hi Nibha,

Can I also request TCLP PAHs on sample TP30 0-0.1 and PAHs on sample 0.2-0.3 on std tat.

Fe02470 Fe2505 409

Thanks,

Katie

From: NibhaVaidya@eurofins.com [mailto:NibhaVaidya@eurofins.com]
Sent: Friday, 9 February 2018 8:01 PM
To: Katie Linz <KLinz@jbsg.com.au>
Cc: Rob Sharp <RSharp@jbsg.com.au>
Subject: Eurofins | mgt Test Results - Report 582994 : Site ST MARYS PSI (54340)

Dear Katie,

Please find attached results for your project in the subject header.

Kind Regards,

Nibha Vaidya
Analytical Services Manager

Eurofins | mgt
Unit F3, Parkview Building
16 Mars Road
LANE COVE WEST NSW 2066

Amy EF/MGT 23/2/18 9:23 582594

Melbourne
3-5 Kingston Town Close
Oakleigh Vic 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
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Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name: **JBS & G Australia (NSW) P/L**

Contact name: Katie Linz
Project name: ST MARYS PSI
Project ID: 54340
COC number: Not provided
Turn around time: 5 Day
Date/Time received: Feb 23, 2018 9:23 AM
Eurofins | mgt reference: **586594**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☒ Split sample sent to requested external lab.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8400 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Katie Linz - klinz@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email address.

Certificate of Analysis

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Katie Linz**

Report **586594-L**
Project name ST MARYS PSI
Project ID 54340
Received Date Feb 23, 2018

Client Sample ID			**TP30 0-0.1**
Sample Matrix			**US Leachate**
Eurofins | mgt Sample No.			**M18-Fe30052**
Date Sampled			**Feb 01, 2018**
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons			
Acenaphthene	0.001	mg/L	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001
Anthracene	0.001	mg/L	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001
Chrysene	0.001	mg/L	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001
Fluoranthene	0.001	mg/L	< 0.001
Fluorene	0.001	mg/L	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001
Naphthalene	0.001	mg/L	< 0.001
Phenanthrene	0.001	mg/L	< 0.001
Pyrene	0.001	mg/L	< 0.001
Total PAH*	0.001	mg/L	< 0.001
2-Fluorobiphenyl (surr.)	1	%	72
p-Terphenyl-d14 (surr.)	1	%	61
USA Leaching Procedure			
Leachate Fluid[C01]		comment	1.0
pH (initial)	0.1	pH Units	7.6
pH (Leachate fluid)	0.1	pH Units	5.0
pH (off)	0.1	pH Units	5.7
pH (USA HCl addition)	0.1	pH Units	1.7

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons	Melbourne	Feb 28, 2018	7 Day

- Method: LTM-ORG-2130 PAH and Phenols in Soils by GCMS

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

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ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
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Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
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1/21 Smallwood Place
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NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Feb 23, 2018 9:23 AM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	586594	**Due:**	Mar 2, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Katie Linz
Project Name:	ST MARYS PSI				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Polycyclic Aromatic Hydrocarbons	USA Leaching Procedure	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794								
Perth Laboratory - NATA Site # 23736								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	TP30 0-0.1	Feb 01, 2018		US Leachate	M18-Fe30052	X	X	
2	TP30 0.2-0.3	Feb 01, 2018		Soil	M18-Fe30053	X		X
Test Counts						2	1	1

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	M18-Fe30018	NCP	%	76			70-130	Pass	
Acenaphthylene	M18-Fe30018	NCP	%	107			70-130	Pass	
Anthracene	M18-Fe30018	NCP	%	91			70-130	Pass	
Benz(a)anthracene	M18-Fe30018	NCP	%	108			70-130	Pass	
Benzo(a)pyrene	M18-Fe30018	NCP	%	84			70-130	Pass	
Benzo(b&j)fluoranthene	M18-Fe30018	NCP	%	88			70-130	Pass	
Benzo(g.h.i)perylene	M18-Fe30018	NCP	%	77			70-130	Pass	
Benzo(k)fluoranthene	M18-Fe30018	NCP	%	83			70-130	Pass	
Chrysene	M18-Fe30018	NCP	%	111			70-130	Pass	
Dibenz(a.h)anthracene	M18-Fe30018	NCP	%	80			70-130	Pass	
Fluoranthene	M18-Fe30018	NCP	%	96			70-130	Pass	
Fluorene	M18-Fe30018	NCP	%	83			70-130	Pass	
Indeno(1.2.3-cd)pyrene	M18-Fe30018	NCP	%	80			70-130	Pass	
Naphthalene	M18-Fe30018	NCP	%	74			70-130	Pass	
Phenanthrene	M18-Fe30018	NCP	%	94			70-130	Pass	
Pyrene	M18-Fe30018	NCP	%	95			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Acenaphthylene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Anthracene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benz(a)anthracene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(a)pyrene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(b&j)fluoranthene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(g.h.i)perylene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(k)fluoranthene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chrysene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Dibenz(a.h)anthracene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluoranthene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluorene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Naphthalene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene	M18-Fe30017	NCP	mg/L	0.001	0.001	27	30%	Pass	
Pyrene	M18-Fe30017	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Qualifier Codes/Comments

Code	Description
C01	Leachate Fluid Key: 1 - pH 5.0; 2 - pH 2.9; 3 - pH 9.2; 4 - Reagent (DI) water; 5 - Client sample, 6 - other
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised By

Nibha Vaidya	Analytical Services Manager
Joseph Edouard	Senior Analyst-Organic (VIC)



Glenn Jackson

National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Certificate of Analysis

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Katie Linz**

Report **586594-S**
Project name ST MARYS PSI
Project ID 54340
Received Date Feb 23, 2018

Client Sample ID			**TP30 0.2-0.3**
Sample Matrix			**Soil**
Eurofins | mgt Sample No.			**M18-Fe30053**
Date Sampled			**Feb 01, 2018**
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons			
Comments			G01
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	2.4
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	4.8
Acenaphthene	0.5	mg/kg	< 2
Acenaphthylene	0.5	mg/kg	< 2
Anthracene	0.5	mg/kg	< 2
Benz(a)anthracene	0.5	mg/kg	< 2
Benzo(a)pyrene	0.5	mg/kg	< 2
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 2
Benzo(g.h.i)perylene	0.5	mg/kg	< 2
Benzo(k)fluoranthene	0.5	mg/kg	< 2
Chrysene	0.5	mg/kg	< 2
Dibenz(a.h)anthracene	0.5	mg/kg	< 2
Fluoranthene	0.5	mg/kg	< 2
Fluorene	0.5	mg/kg	< 2
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 2
Naphthalene	0.5	mg/kg	< 2
Phenanthrene	0.5	mg/kg	< 2
Pyrene	0.5	mg/kg	< 2
Total PAH*	0.5	mg/kg	< 2
2-Fluorobiphenyl (surr.)	1	%	81
p-Terphenyl-d14 (surr.)	1	%	77
% Moisture	1	%	5.2

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons	Melbourne	Feb 26, 2018	14 Day
- Method: LTM-ORG-2130 PAH and Phenols in Soils by GCMS			
% Moisture	Melbourne	Feb 26, 2018	14 Day
- Method: LTM-GEN-7080 Moisture			

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ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Feb 23, 2018 9:23 AM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	586594	**Due:**	Mar 2, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Katie Linz
Project Name:	ST MARYS PSI				
Project ID:	54340				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Polycyclic Aromatic Hydrocarbons	USA Leaching Procedure	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794								
Perth Laboratory - NATA Site # 23736								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	TP30 0-0.1	Feb 01, 2018		US Leachate	M18-Fe30052	X	X	
2	TP30 0.2-0.3	Feb 01, 2018		Soil	M18-Fe30053	X		X
Test Counts						2	1	1

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	78			70-130	Pass	
Acenaphthylene	%	89			70-130	Pass	
Anthracene	%	93			70-130	Pass	
Benz(a)anthracene	%	89			70-130	Pass	
Benzo(a)pyrene	%	95			70-130	Pass	
Benzo(b&j)fluoranthene	%	83			70-130	Pass	
Benzo(g.h.i)perylene	%	80			70-130	Pass	
Benzo(k)fluoranthene	%	129			70-130	Pass	
Chrysene	%	110			70-130	Pass	
Dibenz(a.h)anthracene	%	84			70-130	Pass	
Fluoranthene	%	99			70-130	Pass	
Fluorene	%	98			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	84			70-130	Pass	
Naphthalene	%	92			70-130	Pass	
Phenanthrene	%	101			70-130	Pass	
Pyrene	%	96			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	M18-Fe30315	NCP	%	78			70-130	Pass	
Acenaphthylene	M18-Fe30315	NCP	%	87			70-130	Pass	
Anthracene	M18-Fe30315	NCP	%	94			70-130	Pass	
Benz(a)anthracene	M18-Fe30315	NCP	%	84			70-130	Pass	
Benzo(a)pyrene	M18-Fe30315	NCP	%	90			70-130	Pass	
Benzo(b&j)fluoranthene	M18-Fe30315	NCP	%	83			70-130	Pass	
Benzo(g.h.i)perylene	M18-Fe30315	NCP	%	70			70-130	Pass	
Benzo(k)fluoranthene	M18-Fe30315	NCP	%	117			70-130	Pass	
Chrysene	M18-Fe30315	NCP	%	96			70-130	Pass	
Dibenz(a.h)anthracene	M18-Fe30315	NCP	%	73			70-130	Pass	
Fluoranthene	M18-Fe30315	NCP	%	96			70-130	Pass	
Fluorene	M18-Fe30315	NCP	%	96			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Indeno(1.2.3-cd)pyrene	M18-Fe30315	NCP	%	74			70-130	Pass	
Naphthalene	M18-Fe30315	NCP	%	92			70-130	Pass	
Phenanthrene	M18-Fe30315	NCP	%	98			70-130	Pass	
Pyrene	M18-Fe30315	NCP	%	94			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	M18-Fe30309	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M18-Fe30007	NCP	%	14	15	10	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Qualifier Codes/Comments

Code	Description
G01	The LORs have been raised due to matrix interference
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised By

Nibha Vaidya	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Michael Brancati	Senior Analyst-Inorganic (VIC)



Glenn Jackson

National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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018915

CHAIN OF CUSTODY envirolab 1/1

JBS&G

PROJECT NO.: 54340
PROJECT NAME: Cinhs Road
DATE NEEDED BY: STD TAT
PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688
SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) RShup@jbsg.com.au; (3) KLing@jbsg.com.au

LABORATORY BATCH NO.:
SAMPLERS:
QC LEVEL: NEPM (2013)

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

	SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H. Metals	TRH	BTEX	PAHs	Asbestos	OCP/PCBs	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
1	QC20180202-02	soil	02/02		Jar + Bag + ice										
2	QC20180202-03	↓	↓		↓		X	X	X	X	X	X			
3	QC20180202-04	↓	↓		↓										
4	QC20180205-01	↓	02/05		↓										

Envirolab Services
16 Dalmore Drive
Caribbean Park
Scoresby VIC 3179
Ph: (03) 9763 2500

Job No: 13009
Date Received: 8/2/18
Time Received: 8:30
Received by: CP
Temp: Cool/Ambient 7°C
Cooling: Ice/Icepack
Security: Intact/Broken/None

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: [illegible] DATE: 08/02/18	CONSIGNMENT NOTE NO.	NAME: M. SAMD	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF: JBS&G	TRANSPORT CO.	DATE: 8/2/18	COOLER TEMP ..... deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	OF: ENS	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF:	TRANSPORT CO	NAME: DATE:	COOLER TEMP ..... deg C
		OF:	

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO Forms013 – Chain of Custody - Generic

Samples 2-4 received 9/2/18

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

018914

3/3

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: S-7340
PROJECT NAME: Genus Road
DATE NEEDED BY: STD TAT
LABORATORY BATCH NO.:
SAMPLERS: Kobus Steyn / Sam Heaton
QC LEVEL: NEPM (2013)
PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688
SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) KSteyn@jbsg.com.au; (3) KSmith@jbsg.com.au
COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H. Metals	TEH	BTEX	PAHs	Asbestos	OCP/PCBs	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	NEPM/WA	NOTES:
QA20180202-02	soil	02/02		Soil + Jar - ice		X	X	X	X	X	X			
QA20180202-03														
QA20180202-04														
QA20180205-01		05/02												
QC20180202-02		02/02												
QC20180202-03														
QC20180202-04														
QC20180205-01		05/02												
TS	soil			Vials - ice		X								
TB						X								

Please forward to Envirolab

ENVIROLAB
Envirolab Services
12 Ashley Street
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 13007
Date Received: 05/02/18
Time Received: 8:30
Received by: CE
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

10 C

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: Kobus Steyn DATE: 05/02/18	CONSIGNMENT NOTE NO.	NAME:	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF: JBS&G	TRANSPORT CO.	DATE:	COOLER TEMP ..... deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	OF: NAME: DATE:	COOLER SEAL – Yes..... No ..... Intact ..... Broken .....
OF:	TRANSPORT CO	OF:	COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO Forms013 – Chain of Custody - Generic

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Envirolab Services Pty Ltd
ABN 37 112 535 645 - 002
1 Dalmore Drive Scoresby VIC 3179
ph 03 9763 2500 fax 03 9763 2633
melbourne@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 13001

Client Details

Client	JBS & G Australia Pty Ltd
Attention	K Linz
Address	1/50 Margaret St, Sydney, NSW, 2000

Sample Details

Your Reference	**54340**
Number of Samples	4 Soil
Date samples received	08/02/2018
Date completed instructions received	08/02/2018

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	16/02/2018
Date of Issue	16/02/2018

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Asbestos Approved By
Analysed by Asbestos Approved Identifier: Jessica Hie
Authorised by Asbestos Approved Signatory: Paul Ching

Results Approved By
Chris De Luca, Senior Chemist
Pamela Adams, Laboratory Manager, Melbourne

Authorised By

P. Adams.

Pamela Adams, Laboratory Manager

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		13001-2
Your Reference	UNITS	QC20180202-03
Date Sampled		02/02/2018
Type of sample		Soil
Date extracted	-	13/02/2018
Date analysed	-	15/02/2018
vTRH C_6 - C_9	mg/kg	<25
vTRH C_6 - C_{10}	mg/kg	<25
TRH C_6 - C_{10} less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
Naphthalene	mg/kg	<1
Total +ve Xylenes	mg/kg	<1
Surrogate aaa-Trifluorotoluene	%	99

TRH Soil C10-C40 NEPM		
Our Reference		13001-2
Your Reference	UNITS	QC20180202-03
Date Sampled		02/02/2018
Type of sample		Soil
Date extracted	-	13/02/2018
Date analysed	-	14/02/2018
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
Total +ve TRH (C10-C36)	mg/kg	<50
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	<100
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	87

PAHs in Soil		
Our Reference		13001-2
Your Reference	UNITS	QC20180202-03
Date Sampled		02/02/2018
Type of sample		Soil
Date extracted	-	13/02/2018
Date analysed	-	14/02/2018
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	0.2
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	0.4
Pyrene	mg/kg	0.4
Benzo(a)anthracene	mg/kg	0.2
Chrysene	mg/kg	0.2
Benzo(b,j&k)fluoranthene	mg/kg	0.4
Benzo(a)pyrene	mg/kg	0.25
Indeno(1,2,3-c,d)pyrene	mg/kg	0.2
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	0.2
Total +ve PAH's	mg/kg	2.3
Benzo(a)pyrene TEQ calc (Zero)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc (Half)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc (PQL)	mg/kg	<0.5
Surrogate p-Terphenyl-d_{14}	%	98

OCP in Soil		
Our Reference		13001-2
Your Reference	UNITS	QC20180202-03
Date Sampled		02/02/2018
Type of sample		Soil
Date extracted	-	13/02/2018
Date analysed	-	14/02/2018
alpha-BHC	mg/kg	<0.1
Hexachlorobenzene	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
gamma-BHC	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Aldrin	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
gamma-Chlordane	mg/kg	<0.1
alpha-chlordane	mg/kg	<0.1
Endosulfan I	mg/kg	<0.1
pp-DDE	mg/kg	<0.1
Dieldrin	mg/kg	<0.1
Endrin	mg/kg	<0.1
Endosulfan II	mg/kg	<0.1
pp-DDD	mg/kg	<0.1
Endrin Aldehyde	mg/kg	<0.1
pp-DDT	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Total +ve reported DDT+DDD+DDE	mg/kg	<0.1
Surrogate p-Terphenyl-d_{14}	%	98

PCBs in Soil		
Our Reference		13001-2
Your Reference	UNITS	QC20180202-03
Date Sampled		02/02/2018
Type of sample		Soil
Date extracted	-	13/02/2018
Date analysed	-	14/02/2018
Aroclor 1016	mg/kg	<0.1
Aroclor 1221	mg/kg	<0.1
Aroclor 1232	mg/kg	<0.1
Aroclor 1242	mg/kg	<0.1
Aroclor 1248	mg/kg	<0.1
Aroclor 1254	mg/kg	<0.1
Aroclor 1260	mg/kg	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1
Surrogate p-Terphenyl-d_{14}	%	98

Acid Extractable metals in soil		
Our Reference		13001-2
Your Reference	UNITS	QC20180202-03
Date Sampled		02/02/2018
Type of sample		Soil
Date digested	-	13/02/2018
Date analysed	-	14/02/2018
Arsenic	mg/kg	4
Cadmium	mg/kg	<0.4
Chromium	mg/kg	16
Copper	mg/kg	6
Lead	mg/kg	22
Mercury	mg/kg	<0.1
Nickel	mg/kg	3
Zinc	mg/kg	16

Moisture		
Our Reference		13001-2
Your Reference	UNITS	QC20180202-03
Date Sampled		02/02/2018
Type of sample		Soil
Date prepared	-	13/02/2018
Date analysed	-	14/02/2018
Moisture	%	6.8

Asbestos ID - soils		
Our Reference		13001-2
Your Reference	UNITS	QC20180202-03
Date Sampled		02/02/2018
Type of sample		Soil
Date analysed	-	14/02/2018
Sample mass tested	g	737.98
Sample Description	-	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic Fibres detected
Trace Analysis	-	No asbestos detected

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-008	Moisture content determined by heating at 105 deg C for a minimum of 12 hours.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Note, For OCs the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PAHs" is simply a sum of the positive individual PAHs.

Method ID	Methodology Summary
Org-012	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD or GC-MS. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			13/02/2018	[NT]	[NT]	[NT]	[NT]	13/02/2018	[NT]
Date analysed	-			15/02/2018	[NT]	[NT]	[NT]	[NT]	15/02/2018	[NT]
vTRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	79	[NT]
vTRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	79	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	81	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	83	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	78	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	77	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	76	[NT]
Naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	104	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: TRH Soil C10-C40 NEPM					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			13/02/2018	[NT]	[NT]	[NT]	[NT]	13/02/2018	[NT]
Date analysed	-			14/02/2018	[NT]	[NT]	[NT]	[NT]	14/02/2018	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	87	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	86	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	93	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	87	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	86	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	93	[NT]
Surrogate o-Terphenyl	%		Org-003	88	[NT]	[NT]	[NT]	[NT]	82	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			13/02/2018	[NT]	[NT]	[NT]	[NT]	13/02/2018	[NT]
Date analysed	-			14/02/2018	[NT]	[NT]	[NT]	[NT]	14/02/2018	[NT]
Naphthalene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Phenanthrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Benzo(b,j&k)fluoranthene	mg/kg	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	[NT]	[NT]	[NT]	[NT]	96	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d_{14}	%		Org-012	100	[NT]	[NT]	[NT]	[NT]	96	[NT]

QUALITY CONTROL: OCP in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			13/02/2018	[NT]	[NT]	[NT]	[NT]	13/02/2018	[NT]
Date analysed	-			14/02/2018	[NT]	[NT]	[NT]	[NT]	14/02/2018	[NT]
alpha-BHC	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Hexachlorobenzene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	84	[NT]
gamma-BHC	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	72	[NT]
delta-BHC	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	80	[NT]
gamma-Chlordane	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
alpha-chlordane	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Dieldrin	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Endrin	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan II	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Methoxychlor	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d_{14}	%		Org-012	100	[NT]	[NT]	[NT]	[NT]	96	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			13/02/2018	[NT]	[NT]	[NT]	[NT]	13/02/2018	[NT]
Date analysed	-			14/02/2018	[NT]	[NT]	[NT]	[NT]	14/02/2018	[NT]
Aroclor 1016	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	80	[NT]
Aroclor 1260	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d_{14}	%		Org-012	100	[NT]	[NT]	[NT]	[NT]	96	[NT]

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date digested	-			13/02/2018	[NT]	[NT]	[NT]	[NT]	13/02/2018	[NT]
Date analysed	-			14/02/2018	[NT]	[NT]	[NT]	[NT]	14/02/2018	[NT]
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	[NT]	[NT]	[NT]	[NT]	89	[NT]
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	[NT]	[NT]	[NT]	[NT]	96	[NT]
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Envirolab Services Pty Ltd
ABN 37 112 535 645 - 002
1 Dalmore Drive Scoresby VIC 3179
ph 03 9763 2500 fax 03 9763 2633
melbourne@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	JBS & G Australia Pty Ltd
Attention	K Linz

Sample Login Details

Your reference	54340
Envirolab Reference	13001
Date Sample Received	08/02/2018
Date Instructions Received	08/02/2018
Date Results Expected to be Reported	16/02/2018

Sample Condition

Samples received in appropriate condition for analysis	YES
No. of Samples Provided	4 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	7
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Samples 2-4 received on 09/02/2018 from Eurofins.

Please direct any queries to:

Pamela Adams	Analisa Mathrick
Phone: 03 9763 2500	**Phone: 03 9763 2500**
Fax: 03 9763 2633	**Fax: 03 9763 2633**
Email: padams@envirolab.com.au	**Email: amathrick@envirolab.com.au**

Analysis Underway, details on the following page:

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Envirolab Services Pty Ltd
ABN 37 112 535 645 - 002
1 Dalmore Drive Scoresby VIC 3179
ph 03 9763 2500 fax 03 9763 2633
melbourne@envirolab.com.au
www.envirolab.com.au

Sample ID	vTRH(C6-C10)/BTEXN in Soil	TRH Soil C10-C40 NEPM	PAHs in Soil	OCP in Soil	PCBsin Soil	Acid Extractable metalsin soil	Asbestos ID - soils	On Hold
QC20180202-02								✓
QC20180202-03	✓	✓	✓	✓	✓	✓	✓	
QC20180202-04								✓
QC20180205-01								✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.

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Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 184484

Client Details

Client	JBS & G (NSW & WA) Pty Ltd
Attention	Katie Linz, Robert Sharp
Address	Level 1, 50 Margaret St, Sydney, NSW, 2000

Sample Details

Your Reference	**54340, St Marys PSI**
Number of Samples	2 Soil
Date samples received	05/02/2018
Date completed instructions received	05/02/2018

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	12/02/2018
Date of Issue	09/02/2018

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Asbestos Approved By
Analysed by Asbestos Approved Identifier: Lucy Zhu
Authorised by Asbestos Approved Signatory: Paul Ching

Results Approved By
Dragana Tomas, Senior Chemist
Jeremy Faircloth, Organics Supervisor
Leon Ow, Chemist
Paul Ching, Senior Analyst
Steven Luong, Senior Chemist

Authorised By



David Springer, General Manager

Document Set ID: 8477747
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vTRH(C6-C10)/BTEXN in Soil		
Our Reference		184484-1
Your Reference	UNITS	QC20180201-01
Date Sampled		01/02/2018
Type of sample		Soil
Date extracted	-	06/02/2018
Date analysed	-	07/02/2018
TRH C_6 - C_9	mg/kg	<25
TRH C_6 - C_{10}	mg/kg	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
naphthalene	mg/kg	<1
Total +ve Xylenes	mg/kg	<1
Surrogate aaa-Trifluorotoluene	%	119

svTRH (C10-C40) in Soil		
Our Reference		184484-1
Your Reference	UNITS	QC20180201-01
Date Sampled		01/02/2018
Type of sample		Soil
Date extracted	-	06/02/2018
Date analysed	-	07/02/2018
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	350
TRH C_{29} - C_{36}	mg/kg	300
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	570
TRH >C_{34} -C_{40}	mg/kg	180
Total +ve TRH (>C10-C40)	mg/kg	760
Surrogate o-Terphenyl	%	88

PAHs in Soil		
Our Reference		184484-1
Your Reference	UNITS	QC20180201-01
Date Sampled		01/02/2018
Type of sample		Soil
Date extracted	-	06/02/2018
Date analysed	-	06/02/2018
Naphthalene	mg/kg	3.0
Acenaphthylene	mg/kg	2.3
Acenaphthene	mg/kg	1.2
Fluorene	mg/kg	2.7
Phenanthrene	mg/kg	31
Anthracene	mg/kg	6.4
Fluoranthene	mg/kg	38
Pyrene	mg/kg	35
Benzo(a)anthracene	mg/kg	11
Chrysene	mg/kg	10
Benzo(b,j+k)fluoranthene	mg/kg	23
Benzo(a)pyrene	mg/kg	15
Indeno(1,2,3-c,d)pyrene	mg/kg	10
Dibenzo(a,h)anthracene	mg/kg	2.7
Benzo(g,h,i)perylene	mg/kg	13
Total +ve PAH's	mg/kg	200
Benzo(a)pyrene TEQ calc (zero)	mg/kg	22
Benzo(a)pyrene TEQ calc(half)	mg/kg	22
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	22
Surrogate p-Terphenyl-d14	%	98

Organochlorine Pesticides in soil		
Our Reference		184484-1
Your Reference	UNITS	QC20180201-01
Date Sampled		01/02/2018
Type of sample		Soil
Date extracted	-	06/02/2018
Date analysed	-	06/02/2018
HCB	mg/kg	<0.1
alpha-BHC	mg/kg	<0.1
gamma-BHC	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Aldrin	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
gamma-Chlordane	mg/kg	<0.1
alpha-chlordane	mg/kg	<0.1
Endosulfan I	mg/kg	<0.1
pp-DDE	mg/kg	<0.1
Dieldrin	mg/kg	<0.1
Endrin	mg/kg	<0.1
pp-DDD	mg/kg	<0.1
Endosulfan II	mg/kg	<0.1
pp-DDT	mg/kg	<0.1
Endrin Aldehyde	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1
Surrogate TCMX	%	95

PCBs in Soil		
Our Reference		184484-1
Your Reference	UNITS	QC20180201-01
Date Sampled		01/02/2018
Type of sample		Soil
Date extracted	-	06/02/2018
Date analysed	-	06/02/2018
Aroclor 1016	mg/kg	<0.5
Aroclor 1221	mg/kg	<0.5
Aroclor 1232	mg/kg	<0.5
Aroclor 1242	mg/kg	<0.5
Aroclor 1248	mg/kg	<0.5
Aroclor 1254	mg/kg	<0.5
Aroclor 1260	mg/kg	<0.5
Total +ve PCBs (1016-1260)	mg/kg	<0.5
Surrogate TCLMX	%	95

Acid Extractable metals in soil		
Our Reference		184484-1
Your Reference	UNITS	QC20180201-01
Date Sampled		01/02/2018
Type of sample		Soil
Date prepared	-	06/02/2018
Date analysed	-	06/02/2018
Arsenic	mg/kg	5
Cadmium	mg/kg	<0.4
Chromium	mg/kg	18
Copper	mg/kg	16
Lead	mg/kg	47
Mercury	mg/kg	<0.1
Nickel	mg/kg	6
Zinc	mg/kg	110

Moisture		
Our Reference		184484-1
Your Reference	UNITS	QC20180201-01
Date Sampled		01/02/2018
Type of sample		Soil
Date prepared	-	06/02/2018
Date analysed	-	07/02/2018
Moisture	%	6.6

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Asbestos ID - soils NEPM - ASB-001		
Our Reference		184484-1
Your Reference	UNITS	QC20180201-01
Date Sampled		01/02/2018
Type of sample		Soil
Date analysed	-	09/02/2018
Sample mass tested	g	972.28
Sample Description	-	Brown coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected
Total Asbestos#1	g/kg	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected
ACM >7mm Estimation*	g	–
FA and AF Estimation*	g	–
ACM >7mm Estimation*	%(w/w)	<0.01
FA and AF Estimation*#2	%(w/w)	<0.001

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.

Method ID	Methodology Summary
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date extracted	-			06/02/2018	[NT]	[NT]	[NT]	[NT]	06/02/2018	[NT]
Date analysed	-			07/02/2018	[NT]	[NT]	[NT]	[NT]	07/02/2018	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	94	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	94	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	77	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	100	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	93	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	114	[NT]	[NT]	[NT]	[NT]	121	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date extracted	-			06/02/2018	[NT]	[NT]	[NT]	[NT]	06/02/2018	[NT]
Date analysed	-			06/02/2018	[NT]	[NT]	[NT]	[NT]	06/02/2018	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	128	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	120	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	128	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	120	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
Surrogate o-Terphenyl	%		Org-003	84	[NT]	[NT]	[NT]	[NT]	95	[NT]

QUALITY CONTROL: PAHs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date extracted	-			06/02/2018	[NT]	[NT]	[NT]	[NT]	06/02/2018	[NT]
Date analysed	-			06/02/2018	[NT]	[NT]	[NT]	[NT]	06/02/2018	[NT]
Naphthalene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Phenanthrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	114	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	[NT]	[NT]	[NT]	[NT]	89	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	98	[NT]	[NT]	[NT]	[NT]	116	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	[NT]
Date extracted	-			06/02/2018	[NT]	[NT]	[NT]	[NT]	06/02/2018	[NT]
Date analysed	-			06/02/2018	[NT]	[NT]	[NT]	[NT]	06/02/2018	[NT]
HCB	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	87	[NT]
gamma-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Heptachlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	119	[NT]
delta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Dieldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	117	[NT]
Endrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	109	[NT]
pp-DDD	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Endosulfan II	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Methoxychlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-005	97	[NT]	[NT]	[NT]	[NT]	90	[NT]

QUALITY CONTROL: PCBs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	[NT]
Date extracted	-			06/02/2018	[NT]	[NT]	[NT]	[NT]	06/02/2018	[NT]
Date analysed	-			06/02/2018	[NT]	[NT]	[NT]	[NT]	06/02/2018	[NT]
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCLMX	%		Org-006	97	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date prepared	-			06/02/2018	[NT]	[NT]	[NT]	[NT]	06/02/2018	[NT]
Date analysed	-			06/02/2018	[NT]	[NT]	[NT]	[NT]	06/02/2018	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	114	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	[NT]	[NT]	107	[NT]
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	112	[NT]
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Lead	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	111	[NT]
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

PCBs in Soil (sample 1) - PQL has been raised due to interference from analytes(other than those being tested) in the sample/s.

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.
This is reported outside our scope of NATA accreditation.

Document Set ID: 8477747
Version: 1, Version Date: 26/11/2018

Envirolab.

018708

CHAIN OF CUSTODY

1/1

JBS&G

PROJECT NO.: 54340
PROJECT NAME: St marys PS1
DATE NEEDED BY: Std.

LABORATORY BATCH NO.:
SAMPLERS: Rob Sharp
QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) KLinz@jbsg.com.au; (3) RSharp@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

	SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	H.M	TRH	BTEX	PAHs	Asbestos	OCP/PCB	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
1	QC20180201-01	soil	1/2/18	/	soil jar + bag once		X	X	X	X	X	X			
2	QC20180201-02	↓	↓	/	↓										

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 184484
Date Received: 5/2/18
Time Received: 11:20
Received by: AB
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: K. Linz DATE: 2/2/18 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: Joel B. W DATE: 02/02/18 OF: Envirolab Mayf	COOLER SEAL – Yes..... No ..... Intact ..... Broken ..... COOLER TEMP ..... deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: AB DATE: 5/2/18 OF: ELS	COOLER SEAL – Yes..... No ..... Intact ..... Broken ..... COOLER TEMP ..... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	JBS & G (NSW & WA) Pty Ltd
Attention	Katie Linz, Robert Sharp

Sample Login Details

Your reference	54340, St Marys PSI
Envirolab Reference	184484
Date Sample Received	05/02/2018
Date Instructions Received	05/02/2018
Date Results Expected to be Reported	12/02/2018

Sample Condition

Samples received in appropriate condition for analysis	YES
No. of Samples Provided	2 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	15.1
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticidesin soil	PCBsin Soil	Acid Extractable metalsin soil	Asbestos ID - soils NEPM - ASB-001	On Hold
QC20180201-01	✓	✓	✓	✓	✓	✓	✓	
QC20180201-02								✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.

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Appendix H Statistical Analysis

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	0	1	2	3	4	5	6	7	8	9	10	11
	Zn	d_Zn	Ni	d_Ni	Cu	d_Cu	BaP	d_BaP	BaP TEQ	d_BaP TEQ	C10-C16	d_C10-C16
1	140	1	65	1	37	1	0.5	0	0.5	0	50	0
2	230	1	39	1	33	1	1.9	1	2.5	1	50	0
3	52	1	16	1	14	1	0.5	0	0.5	0	50	0
4	440	1	47	1	56	1	1	1	1.3	1	50	0
5	98	1	13	1	15	1	1.7	1	2.8	1	50	0
6	170	1	46	1	25	1	0.8	1	1	1	50	0
7	180	1	26	1	26	1	2.2	1	2.9	1	50	0
8	180	1	13	1	20	1	5.3	1	8.2	1	50	0
9	100	1	9	1	29	1	1.4	1	1.8	1	50	0
10	550	1	7.6	1	13	1	0.5	0	0.5	0	50	0
11	16	1	5	0	6.8	1	0.5	0	0.5	0	50	0
12	13	1	5	1	8.8	1	0.5	0	0.5	0	93	1
13	24	1	3	1	7.9	1	0.5	0	0.5	0	50	0
14	35	1	5	0	10	1	4.3	1	6.3	1	62	1
15	31	1	7	1	17	1	39	1	60	1	50	0
16	67	1	5.9	1	14	1	4.8	1	7.2	1	100	1
17	37	1	6.5	1	10	1	1.5	1	1.9	1	50	0
18	34	1	5.4	1	13	1	1.3	1	1.7	1	50	0
19	270	1	14	1	30	1	0.6	1	0.7	1	50	0
20	47	1	6	1	19	1	9.6	1	14	1	50	0
21	76	1	9.2	1	26	1	18	1	25	1	50	0
22	130	1	11	1	33	1	12	1	18	1	50	0
23	65	1	7.9	1	20	1	0.5	0	0.5	0	50	0
24	7.6	1	5	0	5.9	1	47	1	73	1	50	0
25	32	1	7.1	1	14	1	1.4	1	1.9	1	50	0
26	7.8	1	5.8	1	7	1	0.5	0	0.5	0	50	0
27	76	1	11	1	29	1	0.5	0	0.5	0	50	0
28	8.8	1	9.2	1	6.6	1	0.5	0	0.5	0	50	0
29	38	1	5.6	1	17	1	0.5	0	0.5	0	1900	1
30	62	1	30	1	59	1	0.6	1	0.7	1	50	0
31	76	1	19	1	78	1	0.5	0	0.5	0	50	0
32	130	1	39	1	56	1	1.6	1	2.1	1		
33	97	1	30	1	86	1	1.2	1	1.5	1		
34	94	1	33	1	76	1	0.5	0	0.5	0		
35	5.6	1	5	0	8.7	1	2	0	0.5	0		
36	210	1	14	1	30	1	16	1	25	1		
37	47	1	29	1	15	1	0.5	0	0.5	0		
38	56	1	84	1	29	1	1.3	1	2.4	1		
39	83	1	12	1	22	1	0.5	0	0.5	0		
40	9.8	1	5	0	11	1	15	1	22	1		
41	58	1	7.6	1	14	1	0.5	0	0.5	0		
42	74	1	32	1	21	1	0.5	0	0.5	0		
43	23	1	6.3	1	8.7	1	0.7	1	0.9	1		
44	7.4	1	5	0	7.7	1	0.5	0	0.5	0		
45	11	1	5	0	8.2	1	0.5	0	0.5	0		
46	32	1	9.5	1	17	1	0.5	0	0.5	0		
47	130	1	13	1	28	1	2.7	1	4.6	1		
48	170	1	38	1	31	1	0.5	0	0.5	0		
49	65	1	5	0	14	1	0.5	0	0.5	0		
50	90	1	11	1	24	1	0.5	0	0.5	0		
51							0.5	0	0.5	0		
52							0.5	0	0.5	0		
53							0.5	0	0.5	0		
54							0.5	0	0.5	0		

	12	13
	C16-C34	d_C16-C34
1	100	1
2	330	1
3	150	1
4	100	0
5	100	0
6	280	1
7	170	1
8	100	0
9	100	0
10	100	0
11	200	1
12	2300	1
13	630	1
14	670	1
15	590	1
16	3200	1
17	110	1
18	100	0
19	100	0
20	100	0
21	150	1
22	760	1
23	100	0
24	570	1
25	100	0
26	100	0
27	100	0
28	100	0
29	6300	1
30	100	0
31	100	0
32		
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UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.125/03/2018 9:55:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zn

General Statistics

Total Number of Observations	50	Number of Distinct Observations	41
		Number of Missing Observations	0
Minimum	5.6	Mean	93.72
Maximum	550	Median	65
SD	104.6	Std. Error of Mean	14.79
Coefficient of Variation	1.116	Skewness	2.61

Normal GOF Test

Shapiro Wilk Test Statistic	0.73	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.947	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.216	Lilliefors GOF Test
5% Lilliefors Critical Value	0.125	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	118.5	95% Adjusted-CLT UCL (Chen-1995)	123.9
		95% Modified-t UCL (Johnson-1978)	119.4

Gamma GOF Test

A-D Test Statistic	0.36	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.778	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0884	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.129	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.095	k star (bias corrected MLE)	1.043
Theta hat (MLE)	85.59	Theta star (bias corrected MLE)	89.89
nu hat (MLE)	109.5	nu star (bias corrected)	104.3
MLE Mean (bias corrected)	93.72	MLE Sd (bias corrected)	91.78
		Approximate Chi Square Value (0.05)	81.7
Adjusted Level of Significance	0.0452	Adjusted Chi Square Value	81.11

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	119.6	95% Adjusted Gamma UCL (use when n<50)	120.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.964	Shapiro Wilk Lognormal GOF Test
5% Shapiro Wilk Critical Value	0.947	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0824	Lilliefors Lognormal GOF Test
5% Lilliefors Critical Value	0.125	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

58					Lognormal Statistics						
59				Minimum of Logged Data	1.723				Mean of logged Data	4.019	
60				Maximum of Logged Data	6.31				SD of logged Data	1.1	
61											
62					Assuming Lognormal Distribution						
63				95% H-UCL	149.9				90% Chebyshev (MVUE) UCL	156.3	
64				95% Chebyshev (MVUE) UCL	181.8				97.5% Chebyshev (MVUE) UCL	217.2	
65				99% Chebyshev (MVUE) UCL	286.7						
66											
67					Nonparametric Distribution Free UCL Statistics						
68					Data appear to follow a Discernible Distribution at 5% Significance Level						
69											
70					Nonparametric Distribution Free UCLs						
71				95% CLT UCL	118				95% Jackknife UCL	118.5	
72				95% Standard Bootstrap UCL	117.6				95% Bootstrap-t UCL	127.5	
73				95% Hall's Bootstrap UCL	142.2				95% Percentile Bootstrap UCL	118.9	
74				95% BCA Bootstrap UCL	123.6						
75				90% Chebyshev(Mean, Sd) UCL	138.1				95% Chebyshev(Mean, Sd) UCL	158.2	
76				97.5% Chebyshev(Mean, Sd) UCL	186.1				99% Chebyshev(Mean, Sd) UCL	240.9	
77											
78					Suggested UCL to Use						
79				95% Approximate Gamma UCL	119.6						
80											
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
82	Recommendations are based upon data size, data distribution, and skewness.										
83	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
84	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
85											
86	Ni										
87											
88					General Statistics						
89				Total Number of Observations	50				Number of Distinct Observations	33	
90				Number of Detects	42				Number of Non-Detects	8	
91				Number of Distinct Detects	33				Number of Distinct Non-Detects	1	
92				Minimum Detect	3				Minimum Non-Detect	5	
93				Maximum Detect	84				Maximum Non-Detect	5	
94				Variance Detects	314.1				Percent Non-Detects	16%	
95				Mean Detects	19.25				SD Detects	17.72	
96				Median Detects	11.5				CV Detects	0.92	
97				Skewness Detects	1.835				Kurtosis Detects	3.661	
98				Mean of Logged Detects	2.621				SD of Logged Detects	0.807	
99											
100					Normal GOF Test on Detects Only						
101				Shapiro Wilk Test Statistic	0.746				Shapiro Wilk GOF Test		
102				5% Shapiro Wilk Critical Value	0.942				Detected Data Not Normal at 5% Significance Level		
103				Lilliefors Test Statistic	0.259				Lilliefors GOF Test		
104				5% Lilliefors Critical Value	0.135				Detected Data Not Normal at 5% Significance Level		
105					Detected Data Not Normal at 5% Significance Level						
106											
107					Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs						
108				KM Mean	16.65				KM Standard Error of Mean	2.45	
109				KM SD	17.12				95% KM (BCA) UCL	21.65	
110				95% KM (t) UCL	20.76				95% KM (Percentile Bootstrap) UCL	20.72	
111				95% KM (z) UCL	20.68				95% KM Bootstrap t UCL	21.56	
112				90% KM Chebyshev UCL	24				95% KM Chebyshev UCL	27.33	
113				97.5% KM Chebyshev UCL	31.95				99% KM Chebyshev UCL	41.03	

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115	Gamma GOF Tests on Detected Observations Only										
116				A-D Test Statistic	1.539	Anderson-Darling GOF Test					
117				5% A-D Critical Value	0.765	Detected Data Not Gamma Distributed at 5% Significance Level					
118				K-S Test Statistic	0.189	Kolmogorov-Smirnov GOF					
119				5% K-S Critical Value	0.139	Detected Data Not Gamma Distributed at 5% Significance Level					
120				Detected Data Not Gamma Distributed at 5% Significance Level							
121											
122	Gamma Statistics on Detected Data Only										
123				k hat (MLE)	1.632			k star (bias corrected MLE)	1.531		
124				Theta hat (MLE)	11.8			Theta star (bias corrected MLE)	12.58		
125				nu hat (MLE)	137.1			nu star (bias corrected)	128.6		
126				Mean (detects)	19.25						
127											
128	Gamma ROS Statistics using Imputed Non-Detects										
129	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs										
130	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)										
131	For such situations, GROS method may yield incorrect values of UCLs and BTVs										
132	This is especially true when the sample size is small.										
133	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates										
134				Minimum	0.01			Mean	16.17		
135				Maximum	84			Median	9.35		
136				SD	17.71			CV	1.095		
137				k hat (MLE)	0.484			k star (bias corrected MLE)	0.468		
138				Theta hat (MLE)	33.41			Theta star (bias corrected MLE)	34.53		
139				nu hat (MLE)	48.41			nu star (bias corrected)	46.84		
140				Adjusted Level of Significance (β)	0.0452						
141				Approximate Chi Square Value (46.84, α)	32.14			Adjusted Chi Square Value (46.84, β)	31.77		
142				95% Gamma Approximate UCL (use when n>=50)	23.57			95% Gamma Adjusted UCL (use when n<50)	23.84		
143											
144	Estimates of Gamma Parameters using KM Estimates										
145				Mean (KM)	16.65			SD (KM)	17.12		
146				Variance (KM)	293			SE of Mean (KM)	2.45		
147				k hat (KM)	0.946			k star (KM)	0.903		
148				nu hat (KM)	94.63			nu star (KM)	90.28		
149				theta hat (KM)	17.6			theta star (KM)	18.44		
150				80% gamma percentile (KM)	27.01			90% gamma percentile (KM)	39.32		
151				95% gamma percentile (KM)	51.73			99% gamma percentile (KM)	80.77		
152											
153	Gamma Kaplan-Meier (KM) Statistics										
154				Approximate Chi Square Value (90.28, α)	69.38			Adjusted Chi Square Value (90.28, β)	68.83		
155				95% Gamma Approximate KM-UCL (use when n>=50)	21.67			95% Gamma Adjusted KM-UCL (use when n<50)	21.84		
156											
157	Lognormal GOF Test on Detected Observations Only										
158				Shapiro Wilk Test Statistic	0.895	Shapiro Wilk GOF Test					
159				5% Shapiro Wilk Critical Value	0.942	Detected Data Not Lognormal at 5% Significance Level					
160				Lilliefors Test Statistic	0.134	Lilliefors GOF Test					
161				5% Lilliefors Critical Value	0.135	Detected Data appear Lognormal at 5% Significance Level					
162				Detected Data appear Approximate Lognormal at 5% Significance Level							
163											
164	Lognormal ROS Statistics Using Imputed Non-Detects										
165				Mean in Original Scale	16.58			Mean in Log Scale	2.343		
166				SD in Original Scale	17.35			SD in Log Scale	0.989		
167				95% t UCL (assumes normality of ROS data)	20.7			95% Percentile Bootstrap UCL	20.72		
168				95% BCA Bootstrap UCL	21.76			95% Bootstrap t UCL	21.37		
169				95% H-UCL (Log ROS)	23.62						
170											
171	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										

KM Mean (logged)	2.377	KM Geo Mean	10.78
KM SD (logged)	0.92	95% Critical H Value (KM-Log)	2.259
KM Standard Error of Mean (logged)	0.132	95% H-UCL (KM -Log)	22.13
KM SD (logged)	0.92	95% Critical H Value (KM-Log)	2.259
KM Standard Error of Mean (logged)	0.132		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	16.57	Mean in Log Scale	2.348
SD in Original Scale	17.36	SD in Log Scale	0.971
95% t UCL (Assumes normality)	20.69	95% H-Stat UCL	23.13

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	22.13

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cu

General Statistics

Total Number of Observations	50	Number of Distinct Observations	33
		Number of Missing Observations	0
Minimum	5.9	Mean	24.15
Maximum	86	Median	18
SD	18.98	Std. Error of Mean	2.685
Coefficient of Variation	0.786	Skewness	1.801

Normal GOF Test

Shapiro Wilk Test Statistic	0.785	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.947	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.18	Lilliefors GOF Test
5% Lilliefors Critical Value	0.125	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	28.65	95% Adjusted-CLT UCL (Chen-1995)	29.29
		95% Modified-t UCL (Johnson-1978)	28.76

Gamma GOF Test

A-D Test Statistic	0.961	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.762	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.103	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.127	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.202	k star (bias corrected MLE)	2.084
Theta hat (MLE)	10.96	Theta star (bias corrected MLE)	11.59

229				nu hat (MLE)	220.2			nu star (bias corrected)	208.4		
230				MLE Mean (bias corrected)	24.15			MLE Sd (bias corrected)	16.73		
231								Approximate Chi Square Value (0.05)	175.9		
232				Adjusted Level of Significance	0.0452			Adjusted Chi Square Value	175.1		
233											
234				Assuming Gamma Distribution							
235			95% Approximate Gamma UCL (use when n>=50)		28.59		95% Adjusted Gamma UCL (use when n<50)		28.74		
236											
237				Lognormal GOF Test							
238				Shapiro Wilk Test Statistic	0.956		Shapiro Wilk Lognormal GOF Test				
239				5% Shapiro Wilk Critical Value	0.947		Data appear Lognormal at 5% Significance Level				
240				Lilliefors Test Statistic	0.072		Lilliefors Lognormal GOF Test				
241				5% Lilliefors Critical Value	0.125		Data appear Lognormal at 5% Significance Level				
242				Data appear Lognormal at 5% Significance Level							
243											
244				Lognormal Statistics							
245				Minimum of Logged Data	1.775			Mean of logged Data	2.94		
246				Maximum of Logged Data	4.454			SD of logged Data	0.689		
247											
248				Assuming Lognormal Distribution							
249				95% H-UCL	29.29			90% Chebyshev (MVUE) UCL	31.45		
250				95% Chebyshev (MVUE) UCL	34.9			97.5% Chebyshev (MVUE) UCL	39.68		
251				99% Chebyshev (MVUE) UCL	49.08						
252											
253				Nonparametric Distribution Free UCL Statistics							
254				Data appear to follow a Discernible Distribution at 5% Significance Level							
255											
256				Nonparametric Distribution Free UCLs							
257				95% CLT UCL	28.56			95% Jackknife UCL	28.65		
258				95% Standard Bootstrap UCL	28.53			95% Bootstrap-t UCL	29.58		
259				95% Hall's Bootstrap UCL	29.39			95% Percentile Bootstrap UCL	28.54		
260				95% BCA Bootstrap UCL	29.41						
261				90% Chebyshev(Mean, Sd) UCL	32.2			95% Chebyshev(Mean, Sd) UCL	35.85		
262				97.5% Chebyshev(Mean, Sd) UCL	40.91			99% Chebyshev(Mean, Sd) UCL	50.86		
263											
264				Suggested UCL to Use							
265				95% Approximate Gamma UCL	28.59						
266											
267			When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test								
268			When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL								
269											
270			Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.								
271			Recommendations are based upon data size, data distribution, and skewness.								
272			These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).								
273			However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.								
274											
275	BaP										
276											
277				General Statistics							
278				Total Number of Observations	54			Number of Distinct Observations	25		
279				Number of Detects	26			Number of Non-Detects	28		
280				Number of Distinct Detects	23			Number of Distinct Non-Detects	2		
281				Minimum Detect	0.6			Minimum Non-Detect	0.5		
282				Maximum Detect	47			Maximum Non-Detect	2		
283				Variance Detects	137.8			Percent Non-Detects	51.85%		
284				Mean Detects	7.419			SD Detects	11.74		
285				Median Detects	1.8			CV Detects	1.582		

286				Skewness Detects	2.47				Kurtosis Detects	5.964	
287				Mean of Logged Detects	1.113				SD of Logged Detects	1.294	
288											
289				Normal GOF Test on Detects Only							
290				Shapiro Wilk Test Statistic	0.618		Shapiro Wilk GOF Test				
291				5% Shapiro Wilk Critical Value	0.92		Detected Data Not Normal at 5% Significance Level				
292				Lilliefors Test Statistic	0.302		Lilliefors GOF Test				
293				5% Lilliefors Critical Value	0.17		Detected Data Not Normal at 5% Significance Level				
294				Detected Data Not Normal at 5% Significance Level							
295											
296				Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs							
297				KM Mean	3.836				KM Standard Error of Mean	1.208	
298				KM SD	8.702				95% KM (BCA) UCL	6.111	
299				95% KM (t) UCL	5.858				95% KM (Percentile Bootstrap) UCL	6.003	
300				95% KM (z) UCL	5.822				95% KM Bootstrap t UCL	7.784	
301				90% KM Chebyshev UCL	7.459				95% KM Chebyshev UCL	9.1	
302				97.5% KM Chebyshev UCL	11.38				99% KM Chebyshev UCL	15.85	
303											
304				Gamma GOF Tests on Detected Observations Only							
305				A-D Test Statistic	1.735		Anderson-Darling GOF Test				
306				5% A-D Critical Value	0.791		Detected Data Not Gamma Distributed at 5% Significance Level				
307				K-S Test Statistic	0.234		Kolmogorov-Smirnov GOF				
308				5% K-S Critical Value	0.179		Detected Data Not Gamma Distributed at 5% Significance Level				
309				Detected Data Not Gamma Distributed at 5% Significance Level							
310											
311				Gamma Statistics on Detected Data Only							
312				k hat (MLE)	0.681				k star (bias corrected MLE)	0.628	
313				Theta hat (MLE)	10.9				Theta star (bias corrected MLE)	11.82	
314				nu hat (MLE)	35.4				nu star (bias corrected)	32.65	
315				Mean (detects)	7.419						
316											
317				Gamma ROS Statistics using Imputed Non-Detects							
318				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
319				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
320				For such situations, GROS method may yield incorrect values of UCLs and BTVs							
321				This is especially true when the sample size is small.							
322				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
323				Minimum	0.01				Mean	3.577	
324				Maximum	47				Median	0.01	
325				SD	8.886				CV	2.484	
326				k hat (MLE)	0.23				k star (bias corrected MLE)	0.23	
327				Theta hat (MLE)	15.54				Theta star (bias corrected MLE)	15.57	
328				nu hat (MLE)	24.86				nu star (bias corrected)	24.81	
329				Adjusted Level of Significance (β)	0.0456						
330				Approximate Chi Square Value (24.81, α)	14.47				Adjusted Chi Square Value (24.81, β)	14.25	
331				95% Gamma Approximate UCL (use when n>=50)	6.135				95% Gamma Adjusted UCL (use when n<50)	6.229	
332											
333				Estimates of Gamma Parameters using KM Estimates							
334				Mean (KM)	3.836				SD (KM)	8.702	
335				Variance (KM)	75.72				SE of Mean (KM)	1.208	
336				k hat (KM)	0.194				k star (KM)	0.196	
337				nu hat (KM)	20.99				nu star (KM)	21.16	
338				theta hat (KM)	19.74				theta star (KM)	19.58	
339				80% gamma percentile (KM)	4.999				90% gamma percentile (KM)	11.6	
340				95% gamma percentile (KM)	19.87				99% gamma percentile (KM)	42.72	
341											
342				Gamma Kaplan-Meier (KM) Statistics							

343	Approximate Chi Square Value (21.16, α)				11.71	Adjusted Chi Square Value (21.16, β)					11.51
344	95% Gamma Approximate KM-UCL (use when n>=50)				6.932	95% Gamma Adjusted KM-UCL (use when n<50)					7.048
345											
346	Lognormal GOF Test on Detected Observations Only										
347	Shapiro Wilk Test Statistic				0.905	Shapiro Wilk GOF Test					
348	5% Shapiro Wilk Critical Value				0.92	Detected Data Not Lognormal at 5% Significance Level					
349	Lilliefors Test Statistic				0.181	Lilliefors GOF Test					
350	5% Lilliefors Critical Value				0.17	Detected Data Not Lognormal at 5% Significance Level					
351	Detected Data Not Lognormal at 5% Significance Level										
352											
353	Lognormal ROS Statistics Using Imputed Non-Detects										
354	Mean in Original Scale				3.652	Mean in Log Scale					-0.722
355	SD in Original Scale				8.856	SD in Log Scale					2.189
356	95% t UCL (assumes normality of ROS data)				5.67	95% Percentile Bootstrap UCL					5.722
357	95% BCA Bootstrap UCL				6.482	95% Bootstrap t UCL					7.326
358	95% H-UCL (Log ROS)				17.44						
359											
360	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										
361	KM Mean (logged)				0.182	KM Geo Mean					1.199
362	KM SD (logged)				1.259	95% Critical H Value (KM-Log)					2.684
363	KM Standard Error of Mean (logged)				0.175	95% H-UCL (KM -Log)					4.215
364	KM SD (logged)				1.259	95% Critical H Value (KM-Log)					2.684
365	KM Standard Error of Mean (logged)				0.175						
366											
367	DL/2 Statistics										
368	DL/2 Normal					DL/2 Log-Transformed					
369	Mean in Original Scale				3.716	Mean in Log Scale					-0.157
370	SD in Original Scale				8.831	SD in Log Scale					1.533
371	95% t UCL (Assumes normality)				5.728	95% H-Stat UCL					5.237
372	DL/2 is not a recommended method, provided for comparisons and historical reasons										
373											
374	Nonparametric Distribution Free UCL Statistics										
375	Data do not follow a Discernible Distribution at 5% Significance Level										
376											
377	Suggested UCL to Use										
378	95% KM (Chebyshev) UCL				9.1						
379											
380	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
381	Recommendations are based upon data size, data distribution, and skewness.										
382	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
383	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
384											
385	BaP TEQ										
386											
387	General Statistics										
388	Total Number of Observations				54	Number of Distinct Observations					24
389	Number of Detects				26	Number of Non-Detects					28
390	Number of Distinct Detects				23	Number of Distinct Non-Detects					1
391	Minimum Detect				0.7	Minimum Non-Detect					0.5
392	Maximum Detect				73	Maximum Non-Detect					0.5
393	Variance Detects				327.8	Percent Non-Detects					51.85%
394	Mean Detects				11.13	SD Detects					18.1
395	Median Detects				2.65	CV Detects					1.627
396	Skewness Detects				2.537	Kurtosis Detects					6.342
397	Mean of Logged Detects				1.453	SD of Logged Detects					1.36
398											
399	Normal GOF Test on Detects Only										

400				Shapiro Wilk Test Statistic	0.611	Shapiro Wilk GOF Test					
401				5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level					
402				Lilliefors Test Statistic	0.295	Lilliefors GOF Test					
403				5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level					
404				Detected Data Not Normal at 5% Significance Level							
405											
406				Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs							
407				KM Mean	5.619	KM Standard Error of Mean	1.862				
408				KM SD	13.42	95% KM (BCA) UCL	8.863				
409				95% KM (t) UCL	8.735	95% KM (Percentile Bootstrap) UCL	8.907				
410				95% KM (z) UCL	8.681	95% KM Bootstrap t UCL	12.07				
411				90% KM Chebyshev UCL	11.2	95% KM Chebyshev UCL	13.73				
412				97.5% KM Chebyshev UCL	17.24	99% KM Chebyshev UCL	24.14				
413											
414				Gamma GOF Tests on Detected Observations Only							
415				A-D Test Statistic	1.552	Anderson-Darling GOF Test					
416				5% A-D Critical Value	0.795	Detected Data Not Gamma Distributed at 5% Significance Level					
417				K-S Test Statistic	0.245	Kolmogorov-Smirnov GOF					
418				5% K-S Critical Value	0.179	Detected Data Not Gamma Distributed at 5% Significance Level					
419				Detected Data Not Gamma Distributed at 5% Significance Level							
420											
421				Gamma Statistics on Detected Data Only							
422				k hat (MLE)	0.64	k star (bias corrected MLE)	0.591				
423				Theta hat (MLE)	17.4	Theta star (bias corrected MLE)	18.82				
424				nu hat (MLE)	33.26	nu star (bias corrected)	30.75				
425				Mean (detects)	11.13						
426											
427				Gamma ROS Statistics using Imputed Non-Detects							
428				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
429				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
430				For such situations, GROS method may yield incorrect values of UCLs and BTVs							
431				This is especially true when the sample size is small.							
432				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
433				Minimum	0.01	Mean	5.364				
434				Maximum	73	Median	0.01				
435				SD	13.64	CV	2.543				
436				k hat (MLE)	0.216	k star (bias corrected MLE)	0.216				
437				Theta hat (MLE)	24.85	Theta star (bias corrected MLE)	24.81				
438				nu hat (MLE)	23.32	nu star (bias corrected)	23.35				
439				Adjusted Level of Significance (β)	0.0456						
440				Approximate Chi Square Value (23.35, α)	13.36	Adjusted Chi Square Value (23.35, β)	13.15				
441				95% Gamma Approximate UCL (use when n>=50)	9.379	95% Gamma Adjusted UCL (use when n<50)	9.527				
442											
443				Estimates of Gamma Parameters using KM Estimates							
444				Mean (KM)	5.619	SD (KM)	13.42				
445				Variance (KM)	180	SE of Mean (KM)	1.862				
446				k hat (KM)	0.175	k star (KM)	0.178				
447				nu hat (KM)	18.94	nu star (KM)	19.23				
448				theta hat (KM)	32.03	theta star (KM)	31.56				
449				80% gamma percentile (KM)	6.922	90% gamma percentile (KM)	16.93				
450				95% gamma percentile (KM)	29.8	99% gamma percentile (KM)	65.93				
451											
452				Gamma Kaplan-Meier (KM) Statistics							
453				Approximate Chi Square Value (19.23, α)	10.28	Adjusted Chi Square Value (19.23, β)	10.1				
454				95% Gamma Approximate KM-UCL (use when n>=50)	10.51	95% Gamma Adjusted KM-UCL (use when n<50)	10.69				
455											
456				Lognormal GOF Test on Detected Observations Only							

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457				Shapiro Wilk Test Statistic	0.921		Shapiro Wilk GOF Test				
458				5% Shapiro Wilk Critical Value	0.92		Detected Data appear Lognormal at 5% Significance Level				
459				Lilliefors Test Statistic	0.189		Lilliefors GOF Test				
460				5% Lilliefors Critical Value	0.17		Detected Data Not Lognormal at 5% Significance Level				
461				Detected Data appear Approximate Lognormal at 5% Significance Level							
462											
463				Lognormal ROS Statistics Using Imputed Non-Detects							
464				Mean in Original Scale	5.45		Mean in Log Scale	-0.548			
465				SD in Original Scale	13.61		SD in Log Scale	2.376			
466			95% t UCL (assumes normality of ROS data)		8.55		95% Percentile Bootstrap UCL	8.92			
467				95% BCA Bootstrap UCL	10.04		95% Bootstrap t UCL	11.99			
468				95% H-UCL (Log ROS)	38.9						
469											
470				Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution							
471				KM Mean (logged)	0.34		KM Geo Mean	1.405			
472				KM SD (logged)	1.416		95% Critical H Value (KM-Log)	2.883			
473			KM Standard Error of Mean (logged)		0.197		95% H-UCL (KM -Log)	6.712			
474				KM SD (logged)	1.416		95% Critical H Value (KM-Log)	2.883			
475			KM Standard Error of Mean (logged)		0.197						
476											
477				DL/2 Statistics							
478			DL/2 Normal				DL/2 Log-Transformed				
479				Mean in Original Scale	5.489		Mean in Log Scale	-0.0194			
480				SD in Original Scale	13.59		SD in Log Scale	1.71			
481				95% t UCL (Assumes normality)	8.585		95% H-Stat UCL	9.087			
482				DL/2 is not a recommended method, provided for comparisons and historical reasons							
483											
484				Nonparametric Distribution Free UCL Statistics							
485				Detected Data appear Approximate Lognormal Distributed at 5% Significance Level							
486											
487				Suggested UCL to Use							
488				KM H-UCL	6.712						
489											
490				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
491				Recommendations are based upon data size, data distribution, and skewness.							
492				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
493				However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
494											
495	C10-C16										
496											
497				General Statistics							
498				Total Number of Observations	31		Number of Distinct Observations	5			
499				Number of Detects	4		Number of Non-Detects	27			
500				Number of Distinct Detects	4		Number of Distinct Non-Detects	1			
501				Minimum Detect	62		Minimum Non-Detect	50			
502				Maximum Detect	1900		Maximum Non-Detect	50			
503				Variance Detects	823829		Percent Non-Detects	87.1%			
504				Mean Detects	538.8		SD Detects	907.7			
505				Median Detects	96.5		CV Detects	1.685			
506				Skewness Detects	1.998		Kurtosis Detects	3.993			
507				Mean of Logged Detects	5.204		SD of Logged Detects	1.578			
508											
509				Normal GOF Test on Detects Only							
510				Shapiro Wilk Test Statistic	0.647		Shapiro Wilk GOF Test				
511				5% Shapiro Wilk Critical Value	0.748		Detected Data Not Normal at 5% Significance Level				
512				Lilliefors Test Statistic	0.436		Lilliefors GOF Test				
513				5% Lilliefors Critical Value	0.375		Detected Data Not Normal at 5% Significance Level				

514				Detected Data Not Normal at 5% Significance Level							
515											
516				Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs							
517				KM Mean	113.1			KM Standard Error of Mean	67.7		
518				KM SD	326.5			95% KM (BCA) UCL	N/A		
519				95% KM (t) UCL	228			95% KM (Percentile Bootstrap) UCL	N/A		
520				95% KM (z) UCL	224.4			95% KM Bootstrap t UCL	N/A		
521				90% KM Chebyshev UCL	316.2			95% KM Chebyshev UCL	408.2		
522				97.5% KM Chebyshev UCL	535.9			99% KM Chebyshev UCL	786.7		
523											
524				Gamma GOF Tests on Detected Observations Only							
525				A-D Test Statistic	0.784			Anderson-Darling GOF Test			
526				5% A-D Critical Value	0.678			Detected Data Not Gamma Distributed at 5% Significance Level			
527				K-S Test Statistic	0.451			Kolmogorov-Smirnov GOF			
528				5% K-S Critical Value	0.409			Detected Data Not Gamma Distributed at 5% Significance Level			
529				Detected Data Not Gamma Distributed at 5% Significance Level							
530											
531				Gamma Statistics on Detected Data Only							
532				k hat (MLE)	0.573			k star (bias corrected MLE)	0.31		
533				Theta hat (MLE)	940.2			Theta star (bias corrected MLE)	1738		
534				nu hat (MLE)	4.584			nu star (bias corrected)	2.479		
535				Mean (detects)	538.8						
536											
537				Gamma ROS Statistics using Imputed Non-Detects							
538				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
539				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
540				For such situations, GROS method may yield incorrect values of UCLs and BTVs							
541				This is especially true when the sample size is small.							
542				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
543				Minimum	0.01			Mean	69.52		
544				Maximum	1900			Median	0.01		
545				SD	340.7			CV	4.901		
546				k hat (MLE)	0.106			k star (bias corrected MLE)	0.118		
547				Theta hat (MLE)	654.1			Theta star (bias corrected MLE)	591.6		
548				nu hat (MLE)	6.59			nu star (bias corrected)	7.286		
549				Adjusted Level of Significance (β)	0.0413						
550				Approximate Chi Square Value (7.29, α)	2.329			Adjusted Chi Square Value (7.29, β)	2.176		
551				95% Gamma Approximate UCL (use when n>=50)	217.5			95% Gamma Adjusted UCL (use when n<50)	N/A		
552											
553				Estimates of Gamma Parameters using KM Estimates							
554				Mean (KM)	113.1			SD (KM)	326.5		
555				Variance (KM)	106571			SE of Mean (KM)	67.7		
556				k hat (KM)	0.12			k star (KM)	0.13		
557				nu hat (KM)	7.437			nu star (KM)	8.051		
558				theta hat (KM)	942.6			theta star (KM)	870.7		
559				80% gamma percentile (KM)	107.9			90% gamma percentile (KM)	326.7		
560				95% gamma percentile (KM)	638.1			99% gamma percentile (KM)	1571		
561											
562				Gamma Kaplan-Meier (KM) Statistics							
563				Approximate Chi Square Value (8.05, α)	2.764			Adjusted Chi Square Value (8.05, β)	2.595		
564				95% Gamma Approximate KM-UCL (use when n>=50)	329.3			95% Gamma Adjusted KM-UCL (use when n<50)	350.8		
565											
566				Lognormal GOF Test on Detected Observations Only							
567				Shapiro Wilk Test Statistic	0.748			Shapiro Wilk GOF Test			
568				5% Shapiro Wilk Critical Value	0.748			Detected Data appear Lognormal at 5% Significance Level			
569				Lilliefors Test Statistic	0.398			Lilliefors GOF Test			
570				5% Lilliefors Critical Value	0.375			Detected Data Not Lognormal at 5% Significance Level			

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571	Detected Data appear Approximate Lognormal at 5% Significance Level										
572											
573	Lognormal ROS Statistics Using Imputed Non-Detects										
574				Mean in Original Scale	70.39				Mean in Log Scale	-2.421	
575				SD in Original Scale	340.5				SD in Log Scale	4.601	
576			95% t UCL (assumes normality of ROS data)		174.2			95% Percentile Bootstrap UCL		192.6	
577				95% BCA Bootstrap UCL	256.8				95% Bootstrap t UCL	1341	
578				95% H-UCL (Log ROS)	2962151						
579											
580	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										
581				KM Mean (logged)	4.079				KM Geo Mean	59.07	
582				KM SD (logged)	0.655			95% Critical H Value (KM-Log)		2.059	
583			KM Standard Error of Mean (logged)		0.136			95% H-UCL (KM -Log)		93.6	
584				KM SD (logged)	0.655			95% Critical H Value (KM-Log)		2.059	
585			KM Standard Error of Mean (logged)		0.136						
586											
587	DL/2 Statistics										
588	DL/2 Normal						DL/2 Log-Transformed				
589				Mean in Original Scale	91.29				Mean in Log Scale	3.475	
590				SD in Original Scale	336.2				SD in Log Scale	0.841	
591			95% t UCL (Assumes normality)		193.8			95% H-Stat UCL		64.89	
592	DL/2 is not a recommended method, provided for comparisons and historical reasons										
593											
594	Nonparametric Distribution Free UCL Statistics										
595	Detected Data appear Approximate Lognormal Distributed at 5% Significance Level										
596											
597	Suggested UCL to Use										
598				95% KM (Chebyshev) UCL	408.2						
599											
600	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
601	Recommendations are based upon data size, data distribution, and skewness.										
602	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
603	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
604											
605	C16-C34										
606											
607	General Statistics										
608				Total Number of Observations	31				Number of Distinct Observations	15	
609				Number of Detects	16				Number of Non-Detects	15	
610				Number of Distinct Detects	15				Number of Distinct Non-Detects	1	
611				Minimum Detect	100				Minimum Non-Detect	100	
612				Maximum Detect	6300				Maximum Non-Detect	100	
613				Variance Detects	2706896				Percent Non-Detects	48.39%	
614				Mean Detects	1032				SD Detects	1645	
615				Median Detects	450				CV Detects	1.594	
616				Skewness Detects	2.62				Kurtosis Detects	7.16	
617				Mean of Logged Detects	6.129				SD of Logged Detects	1.231	
618											
619	Normal GOF Test on Detects Only										
620				Shapiro Wilk Test Statistic	0.604			Shapiro Wilk GOF Test			
621				5% Shapiro Wilk Critical Value	0.887			Detected Data Not Normal at 5% Significance Level			
622				Lilliefors Test Statistic	0.378			Lilliefors GOF Test			
623				5% Lilliefors Critical Value	0.213			Detected Data Not Normal at 5% Significance Level			
624	Detected Data Not Normal at 5% Significance Level										
625											
626	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
627				KM Mean	581				KM Standard Error of Mean	229.2	

628				KM SD	1236			95% KM (BCA) UCL	996.5		
629				95% KM (t) UCL	970			95% KM (Percentile Bootstrap) UCL	976.8		
630				95% KM (z) UCL	958			95% KM Bootstrap t UCL	1549		
631				90% KM Chebyshev UCL	1269			95% KM Chebyshev UCL	1580		
632				97.5% KM Chebyshev UCL	2012			99% KM Chebyshev UCL	2861		
633											
634				Gamma GOF Tests on Detected Observations Only							
635				A-D Test Statistic	1.063	Anderson-Darling GOF Test					
636				5% A-D Critical Value	0.775	Detected Data Not Gamma Distributed at 5% Significance Level					
637				K-S Test Statistic	0.253	Kolmogorov-Smirnov GOF					
638				5% K-S Critical Value	0.223	Detected Data Not Gamma Distributed at 5% Significance Level					
639				Detected Data Not Gamma Distributed at 5% Significance Level							
640											
641				Gamma Statistics on Detected Data Only							
642				k hat (MLE)	0.74			k star (bias corrected MLE)	0.643		
643				Theta hat (MLE)	1394			Theta star (bias corrected MLE)	1604		
644				nu hat (MLE)	23.69			nu star (bias corrected)	20.58		
645				Mean (detects)	1032						
646											
647				Gamma ROS Statistics using Imputed Non-Detects							
648				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
649				GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
650				For such situations, GROS method may yield incorrect values of UCLs and BTVs							
651				This is especially true when the sample size is small.							
652				For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
653				Minimum	0.01			Mean	532.6		
654				Maximum	6300			Median	100		
655				SD	1276			CV	2.396		
656				k hat (MLE)	0.145			k star (bias corrected MLE)	0.152		
657				Theta hat (MLE)	3683			Theta star (bias corrected MLE)	3501		
658				nu hat (MLE)	8.966			nu star (bias corrected)	9.432		
659				Adjusted Level of Significance (β)	0.0413						
660				Approximate Chi Square Value (9.43, α)	3.59			Adjusted Chi Square Value (9.43, β)	3.391		
661				95% Gamma Approximate UCL (use when n>=50)	1399			95% Gamma Adjusted UCL (use when n<50)	1481		
662											
663				Estimates of Gamma Parameters using KM Estimates							
664				Mean (KM)	581			SD (KM)	1236		
665				Variance (KM)	1526660			SE of Mean (KM)	229.2		
666				k hat (KM)	0.221			k star (KM)	0.221		
667				nu hat (KM)	13.71			nu star (KM)	13.71		
668				theta hat (KM)	2628			theta star (KM)	2626		
669				80% gamma percentile (KM)	803.7			90% gamma percentile (KM)	1755		
670				95% gamma percentile (KM)	2913			99% gamma percentile (KM)	6052		
671											
672				Gamma Kaplan-Meier (KM) Statistics							
673				Approximate Chi Square Value (13.71, α)	6.376			Adjusted Chi Square Value (13.71, β)	6.099		
674				95% Gamma Approximate KM-UCL (use when n>=50)	1250			95% Gamma Adjusted KM-UCL (use when n<50)	1306		
675											
676				Lognormal GOF Test on Detected Observations Only							
677				Shapiro Wilk Test Statistic	0.921	Shapiro Wilk GOF Test					
678				5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level					
679				Lilliefors Test Statistic	0.154	Lilliefors GOF Test					
680				5% Lilliefors Critical Value	0.213	Detected Data appear Lognormal at 5% Significance Level					
681				Detected Data appear Lognormal at 5% Significance Level							
682											
683				Lognormal ROS Statistics Using Imputed Non-Detects							
684				Mean in Original Scale	544			Mean in Log Scale	4.452		

685				SD in Original Scale	1271				SD in Log Scale	2.122		
686			95% t UCL (assumes normality of ROS data)		931.5				95% Percentile Bootstrap UCL	917		
687				95% BCA Bootstrap UCL	1131				95% Bootstrap t UCL	1630		
688				95% H-UCL (Log ROS)	3841							
689												
690				Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution								
691				KM Mean (logged)	5.392				KM Geo Mean	219.6		
692				KM SD (logged)	1.146				95% Critical H Value (KM-Log)	2.601		
693			KM Standard Error of Mean (logged)		0.213				95% H-UCL (KM -Log)	729.7		
694				KM SD (logged)	1.146				95% Critical H Value (KM-Log)	2.601		
695			KM Standard Error of Mean (logged)		0.213							
696												
697				DL/2 Statistics								
698			DL/2 Normal						DL/2 Log-Transformed			
699				Mean in Original Scale	556.8				Mean in Log Scale	5.056		
700				SD in Original Scale	1266				SD in Log Scale	1.423		
701			95% t UCL (Assumes normality)		942.6				95% H-Stat UCL	935.8		
702				DL/2 is not a recommended method, provided for comparisons and historical reasons								
703												
704				Nonparametric Distribution Free UCL Statistics								
705				Detected Data appear Lognormal Distributed at 5% Significance Level								
706												
707				Suggested UCL to Use								
708				KM H-UCL	729.7							
709												
710	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
711	Recommendations are based upon data size, data distribution, and skewness.											
712	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
713	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
714												

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