



Springvale Water Treatment Project

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Environmental Impact Statement
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EnergyAustralia



Centennial Coal

Appendix C Biodiversity



Biodiversity Assessment Report

Springvale Water Treatment Project

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- Appendix 1 Biodiversity Inventory and EPBC Act Assessment (RPS 2016)
- Appendix 2 Northern and Southern Study Area – Credit Reports
- Appendix 3 Staff Curriculum Vitae

Summary

RPS Australia East Pty Ltd (RPS) has been engaged by Springvale Coal Pty Limited (Springvale Coal) to undertake a biodiversity impact assessment for the proposed Springvale Water Treatment Project (the Project), a State Significant Development (SSD). The Biodiversity Assessment Report (BAR) (this report) has the purpose of forming part of the Environmental Impact Statement (EIS) for the Project.

The Project and Project Application Area

The Project aims to improve water quality in the upper Cocks River catchment through the transfer of water from existing underground mine dewatering facilities for reuse at the Mount Piper Power Station (MPPS) cooling towers as a first priority, rather than discharge into the upper catchment of the Cocks River. Discharge of treated mine water will only occur when MPPS is not operating at full capacity.

The Project Application area comprises a number of infrastructure elements primarily including a 10 m wide linear pipeline corridor extending between the existing Gravity Tank on Newnes Plateau and the Water Treatment Plant location within the MPPS site. Other infrastructure includes the existing Gravity Tank site compound, the water treatment plant location at MPPS and a network of pipelines from the water treatment plant to the Springvale Coal Services Site and the cooling towers at MPPS.

A northern and southern pipeline alignment has been investigated on the Newnes Plateau. In this report the northern pipeline alignment is referred to as the Northern Study Area while the southern pipeline alignment is referred to as the Southern Study Area. Only one of these alignments will be selected when constructing the Project.

Impact Analysis

This BAR has been prepared with reference to the NSW BioBanking Assessment Methodology 2014 (BBAM 2014) as part of the *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects* (FBA) (OEH 2014a). The FBA provides a dual assessment process for the development's impact and evaluation of suitable biodiversity offset options within a three stage investigation as listed below:

- **Stage 1** – Biodiversity Assessment;
- **Stage 2** – Impact Assessment (Biodiversity Values); and
- **Stage 3** – Biodiversity Offset Package.

This BAR includes the credit calculations that define the offset requirement for the Project site (Stages 1 & 2). The Stage 3 assessment represents the calculation for the offset package and has been compiled from offset lands described in Centennial Coal's Western Region Biodiversity Offset Package (Centennial Coal 2016).

Impact Minimisation

Impact avoidance opportunities are proposed to reduce the loss of biodiversity values within the Study Area (i.e. use of existing disturbed lands and pre-clearance surveys to avoid threatened plant and hollow-bearing trees). Impact minimisation and mitigation measures are also recommended to further minimise the potential flora and fauna impacts of the clearing, construction and operation of the proposal.

The Southern Study Area has an estimated 3.60 ha of additional clearing compared to the Northern Study Area. Consequently, the Ecosystem Credit requirements for the Southern Study Area are greater (i.e. additional 157 ecosystem credits). Conversely, the Northern Study Area requires a slightly higher number of

Species credits to be retired due to the larger area of potential habitat for the Large-eared Pied Bat. Overall, it is considered that the Northern Study Area would result in a lower biodiversity impact compared to the Southern Study Area. Consequently, the Northern Study Area has been selected as the preferred route and Southern Study Area is not discussed any further in the following Biodiversity Offset Package (BOP).

Biodiversity Offset Package

The Project fits within the Western Region Biodiversity Offset Package (WRBOP) (Centennial Coal 2016 *in prep.*) and has been relied on in the compilation of the BOP for this Project. The WRBOP comprises a number of Centennial owned/ controlled sites identified in the Strategic Lands Assessment (Centennial 2012) as suitable for biodiversity offsetting purposes. The WRBOP includes offset lands, land management initiatives and rehabilitation as part of a holistic approach to conservation and enhancement of biodiversity values within the greater Lithgow area (Centennial Coal 2016 *in prep.*). The following sections outline how the WRBOP (Centennial Coal 2016 *in prep.*) was used to address the offsetting requirements for this Project.

Ecosystem Credits

Section 10.5.4.1 of the FBA allows for a variation to ecosystem credit trading as specified in Section 10.5.3 (i.e. like for like plant community types (PCTs)). A comparison between the Projects' offsetting requirements and WRBOP ecosystem credit availability at a vegetation formation level is provided in **Table 1** to investigate the alternative trading arrangements available under the FBA. Negative balances are presented in (brackets).

Table 1 Net Balance: Formation 'Like for Like' Ecosystem Credit

Formation	WRBOP Credits ¹	Project Application Area (Northern Study Area)	
		Required Credits	WRBOP Net Balance
Grassy Woodlands ²	3,518	22	3,496
Dry Sclerophyll Forests (Shrubby subformation)	2,267	984	1,283
Wet Sclerophyll Forests (Shrubby subformation)	(953)	58	(1,011)
Freshwater Wetlands	10	9	1
Total	4,852	1,082	3,770

Using FBA variation rule Section 10.5.4.2(a), the WRBOP would satisfy the ecosystem credit demand for all PCTs impacted by the Project with the exception of HN558 Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands Bioregion (i.e. offsetting at a vegetation formation level). As HN558 is not listed as a threatened ecological community under the EPBC Act, it is possible to consider the application of FBA variation rule Section 10.5.4.2(b) to address this shortfall. Pending consideration of this offsetting approach by the OEH, it is considered that the Project can satisfy its biodiversity offsetting requirements in a manner compliant with the FBA.

¹ Current ecosystem credit ledger that has taken into account commitments for other projects included in the WRBOP

² Includes PCTs listed and Endangered or Critically Endangered Ecological Communities and are thus suitable for offset trading considerations under Section 10.5.4.2(b) of the FBA

Species Credits

The WRBOP is deficient in the provision of 'like for like' species credits for all three species credit species. However, section 10.5.7.1 of the FBA allows for a variation to species credit trading as specified in Section 10.5.6 (i.e. 'like for like' species credits). A comparison between the Projects offsetting requirements and WRBOP species credit availability at a life-form (flora) or 'order' (fauna) level, as permitted under Section 10.5.7.3(b) of the FBA, is provided in **Table 2** to investigate the alternative trading arrangements available under the FBA.

Table 2 Potential Offset Site Suitability: 'Like for Like' Threatened Species

Impact Species	WRBOP Alternative species ³	WRBOP	Project Application Area (Northern Study Area)	
			Required Credits	WRBOP Net Balance
<i>Eucalyptus cannonii</i> (Capertee Stringybark)	<i>Eucalyptus aggregata</i> (Black Gum)	2,436	39	2,397
<i>Caesia parviflora</i> var. <i>minor</i> (Pale Grass-lily)	No Schedule 1 or 1A species available as alternative	0	42 ⁴	(42)
Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	(1,015)	9	(1,024)
Total		4,322	90	1,331

The WRBOP would satisfy, at a life-form or 'order' level, the Projects' species credit demand for one of the three species impacted (i.e. use of variation rule specified under Section 10.5.7.3(b) of the FBA). Variation rules cannot be applied to the Large-eared Pied Bat (*Chalinolobus dwyeri*), as this species is listed on the EPBC Act (exclusion identified under Section 10.5.7.2(b)). The WRBOP would be in deficit for this species.

However, alternative offsetting arrangements exist for *Caesia parviflora* var. *minor* (Pale Grass-lily) despite the unavailability of a 'like for like' or suitable variation option under Section 10.5.7.3(b) of the FBA). Additional species credit trading options would need to be incorporated into the WRBOP to satisfy a variation under Section 10.5.7.3(b) (i.e. find an offset site containing an endangered or critically endangered flora species listed under the TSC Act) or consider options for supplementary measures for species credits under Section 10.5.7.5. The most suitable offsetting approach would be determined following the consideration of impact avoidance options available at the detailed design and/ or construction stage (i.e. use of pre-clearance surveys to achieve impact avoidance outcomes).

³ Plant species identified as being potentially suitable for offsetting under FBA variation rule Section 10.5.7.3(b)

⁴ Assumed impact. Liability may be reduced following implementation of impact avoidance during detailed design/ construction stages (i.e. pre-clearance surveys).

Stage I – Biodiversity Assessment

I.0 Introduction

RPS Australia East Pty Ltd (RPS) has been engaged by Springvale Coal Pty Limited (Springvale Coal) to undertake a biodiversity impact assessment for the Springvale Water Treatment Project (hereafter referred to as the 'Project'). The Project has the aim of improving environmental outcomes and water quality in the upper Cocks River catchment through the transfer of water from existing underground mine dewatering facilities for reuse at the Mount Piper Power Station (MPPS) rather than discharging into the catchment. Discharges of treated water will only occur when MPPS is not operating at full capacity.

This Biodiversity Assessment Report (BAR) has been prepared with reference to the NSW BioBanking Assessment Methodology (BBAM) as part of the *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects* (FBA) (OEI 2014a). The FBA provides a dual assessment process for the developments impact and evaluation of suitable biodiversity offset options within a three stage investigation as listed below:

- Stage 1 – Biodiversity Assessment;
- Stage 2 – Impact Assessment (Biodiversity Values); and
- Stage 3 – Biodiversity Offset Package.

The FBA requires offset sites to be selected, surveyed, calculated and reported on (Stage 3). However, the Stage 3 assessment is dependent on the results of the Stage 1 & 2 results. At this point in time, this BAR only includes the calculations for the credits required for the development site (Stages 1 & 2). Given this, the Stage 3 assessment will be conducted following consultation with Springvale Coal with regard to results herewith and the identification of the proposed offset package.

A Biodiversity Inventory and EPBC Act Assessment Report is appended (Appendix 1) to supplement the BAR. This report contains a detailed description of the biodiversity values within the Study Area and methods used to define the values. An assessment of Matters of National Environmental Significance (MNES) is also included together with assessments for other matters not assessed under the FBA (e.g. State Environmental Planning Policies (SEPPs)).

The linear based BioBanking Major Project development module, which was launched on 15 July 2015, was used to assess the development impacts presented herewith.

I.1 Project Description

Springvale and Angus Place Collieries operate a water management scheme, referred to as the Springvale Delta Water Transfer Scheme (SDWTS), for the management of safe water levels in the underground workings at both mines. The SDWTS incorporates a network of pipelines connecting the dewatering bore facilities on the Newnes Plateau to Springvale Mine's licensed discharge points (LDP) (i.e. LDP009 and LDP010), where the mine water is currently discharged into Cocks River via the Swayers Swamp Creek.

EnergyAustralia owns and operates the MPPS, about eight kilometres west of the Springvale Mine pit top. MPPS has a high demand for make-up water for use in the cooling tower system. Water is currently drawn from the Cocks River and Fish River water supply schemes. MPPS operates as a zero discharge site with no release of water or by-products (eg. brine) from the cooling tower system to receiving waters. MPPS has an existing brine management system for the treatment and disposal of brine on site.

The Project involves establishing a pipeline and ancillary facilities to transfer water from existing dewatering facilities on the Newnes Plateau for treatment and reuse at MPPS. An overview of the Project is shown on **Figure 1** and includes the following major elements:

- A system to transfer up to 36 ML/day of dewatered mine water from the existing gravity tank forming part of Springvale Mine's approved dewatering facilities on the Newnes Plateau, to a new water treatment plant at the MPPS site;
- A new water treatment plant incorporating desalination processes to reduce the salinity of mine water to a standard suitable for either industrial reuse or environmental release;
- Transfer of treated water from the water treatment plant to the MPPS cooling tower to contribute to the demand for make-up water;
- Transfer of any excess treated water to the Springvale Coal Services site (Western Coal Services Project, SSD 5579) for direct environmental release to Wangcol Creek;
- Transfer of the saline brine stream from the water treatment plant to the MPPS cooling tower blowdown system for integration with existing treatment and brine disposal practices;
- Installation of a crystalliser to provide further treatment of the additional salt load generated within the MPPS cooling tower blowdown system; and
- A truck turning bay and pipeline storage area along the southern alignment only.

Two Project alignments are assessed separately in this report; a northern alignment (Northern Study Area) and a southern alignment (Southern Study Area). Collectively the Northern Study Area and the Southern Study Area are hereafter termed the Study Area. One alignment will ultimately be selected for final placement of the pipeline. Biodiversity investigations have been performed within the Study Area to determine the alignment with the least impact.

1.2 The Study Area

The location and extent of the Study Area is shown in **Figure 1**. The Study Area has an area of approximately 98 ha comprising two pipeline corridors of 20 m width, which are separately referred to as the:

- Northern Study Area; and
- Southern Study Area.

Survey effort, desktop analysis and results have been considered for the entire Study Area, whilst the disturbance or impact footprint is referred to when considering the Project's direct impacts. The preferred route, termed the Project Application Area, is described in Stage 3 of this report following a detailed consideration of the impacts within the Northern Study Area and Southern Study Area

1.3 Potential Disturbance Footprint

For the purposes of this assessment the impact area or disturbance footprint is defined by the extent of native vegetation removal within the preferred route. Native vegetation removal will be restricted to a 10 m wide corridor along the preferred route within which all construction works associated with pipeline installation are to be contained. Two potential disturbance footprints, these being the Northern and Southern Study Areas, have been mapped and are calculated below:

- Northern Study Area (~27.84 ha of native vegetation cover); and
- Southern Study Area (~31.44 ha of native vegetation cover).

1.4 Site Particulars

Locality The pipeline extends from the Gravity Tank on the Newnes Plateau westwards to the Mount Piper Power Station in the Lithgow Local Government Area. The water treatment plant will be located at the MPPS site.

Boundaries	The western portion of the Study Area is surrounded by industrial and agricultural lands accommodating infrastructure, cleared lands and road networks. The Newnes State Forest occurs to the eastern end of the Study Area and bounds the north, east and the southeast of the Study Area (see Figure 1).
Current Land Use	Part of the Study Area (the eastern portion) is contained within Newnes State Forest which is managed by Forestry Corporation of NSW. Other areas of the Study Area are situated within Centennial owned lands, private lands and EnergyAustralia lands with uses such as mining, forestry, pastoral farming and energy resources.
Topography	The landscape in this region ranges from flat to gently inclined rises on broad (>300 m) valley floors away from drainage lines. The local relief is <25 m with a slope gradient typically <10% (King 1993). The main drainage line intersecting the Study Area is the Coxs River; a sixth order stream. The Wangcol Creek tributary extends to the north of the western portion of the Study Area, orientated on an approximate east-west axis. Several small tributaries of the Wangcol Creek extend into the Study Area.
Geology and Soils	The Study Area extends from Mount Piper Power Station near Wallerawang in the west to the Newnes Plateau in the east in the Blue Mountains. The Newnes Plateau surface is gently to moderately inclined covered by friable Narrabeen Group sandstones and pagoda rock formations on the plateau margins. Vertical sandstone cliffs descend from the edge of the plateau in the eastern part of the Study Area. The western part of the Study Area is characterised by gently undulating to rolling hills on the Permian and Devonian sedimentary sequences and minor Carboniferous granites (King 1993: 2-3). Much of the Study Area are in disturbed terrain. The geology for the Study Area is primarily an undifferentiated mix of sandstone, shale and tuff, formed on the Narrabeen Group, laid down in the Triassic period. This is bounded by nearby deposits of the Illawarra Coal Measures (Pi) laid down in the Permian period, comprising shale, sandstone, conglomerate and chert, with coal and seams of torbanite and a quaternary alluvium of gravel, sand, silt and clay, found mainly along watercourses (Bryan, 1966).
Vegetation	Vegetation within the Study Area is dominated by three distinct vegetation types; dense low swamp shrubby vegetation along the drainage lines; eucalypt forest and woodland vegetation on the slopes and flats; and ridges and dry rocky heath along cliffs and ridgetops.

1.5 Background Information

A review of relevant information was performed to identify the biodiversity values occurring or potentially occurring within the Study Area (**Appendix 1**). This included previous ecological reports, vegetation maps, topographic maps, aerial photography and general scientific literature reviews. Of particular relevance were a number of previous RPS assessments, some of which contain unpublished data (RPS 2011, RPS 2012, RPS 2014a and RPS 2014b).

RPS has utilised the information from previous RPS assessments noted above as a baseline, and undertaken a suite of ecological survey work across the Study Area in order to update the dataset, and to

assess significant habitat features of the Study Area and their potential to support threatened species, populations, endangered ecological communities (EECs) and their habitats.

Additional targeted fieldwork has also been undertaken in accordance with the FBA methodology to assess impacts and to inform biodiversity offsets considerations for the Project.

2.0 Biodiversity Assessment

The biodiversity values of the Study Area have been quantified in accordance with the BioBanking Assessment Methodology 2014 (BBAM 2014) using the linear assessment module. Supplementary information used to perform this assessment is provided in Appendix 1 (Biodiversity Inventory Report).

2.1 Identified Landscape Features

The Study Area is situated within the:

- Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion, the Capertee and Wollemi IBRA Subregions;
- Newnes Plateau and the Capertee Plateau Mitchell Landscape; and
- Hawkesbury/Nepean Catchment Management Area (CMA).

Landscape features identified within the Study Area and surrounding assessment buffers are shown in **Figure 2** and **Figure 3**.

2.2 Determining Landscape Value

The Landscape Value of the Study Area is scored based on several variables including:

- Percentage Native Vegetation Cover;
- Connectivity Values; and
- Patch Size.

2.2.1 Percentage Native Vegetation Cover

Geographic Information System (GIS) was used to calculate the current and future percentage of native vegetation cover. A buffer of 550 m width compliant with the linear assessment module of the BBAM 2014 was created either side of the Study Area centreline for this purpose (see **Figure 2** and **Figure 3**). Percentage native vegetation cover within the 550 m buffer was estimated in increments of 5% using GIS for 'Before' and 'After' the development scenario as shown in **Table 3**.

Table 3 Percent Native Vegetation Cover Assessment

Study Area	Before Development	After Development
Northern Study Area	51-56%	51-56%
Southern Study Area	56-60%	56-60%

2.2.2 Connectivity Value

Step 1:

A desktop Connectivity Condition assessment was undertaken by assessing the average condition of native vegetation across the Study Areas 'Primary' linkages to adjoining vegetation. Primary linkages are defined as native vegetation that:

- Is in moderate to good condition;
- Has a patch size > 1 hectare in area;
- Is separated by a distance of <100 metres; and

- Is not separated by a dual carriageway or wider highway or similar hostile link.

Parts of the Study Area are part of a connecting link of native vegetation.

Step 2:

The Study Area intersects a 'State Significant Biodiversity Link' which is a riparian buffer of a 6th order stream (i.e. Cocks River).

2.2.3 Patch Size

To assess the Patch Size, the assessment must:

- Determine the percent native vegetation cleared in the Mitchell Landscape in which most of the development occurs. In this case the majority of the Southern and the Northern Study Areas occur in the Capertee Plateau Mitchell Landscape. The Capertee Plateau Mitchell Landscape is currently 59% cleared; and
- Determine the Patch size class, which in this instance is 'extra large'.

Based on the above, the 'Patch Size Score' for both the Southern and Northern Study Areas were calculated to be 12.5.

2.2.4 Area to Perimeter Ratio

GIS was used to calculate the area (m²) and perimeter (m) of each separate patch >1 ha within the 550 m buffer zone that will be impacted by development. The total area to perimeter ratios before and after development were calculated and shown in **Table 4**.

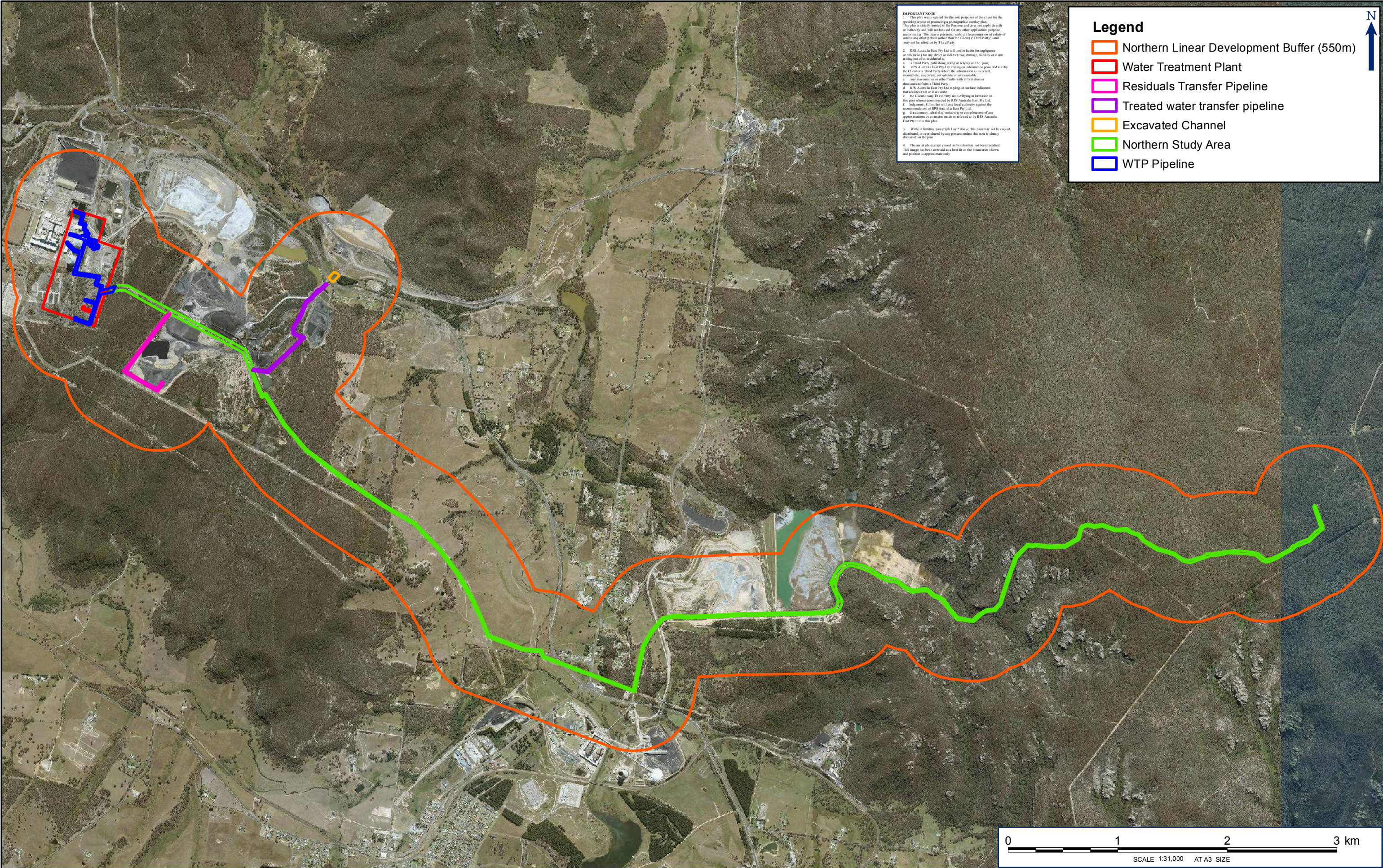
Table 4 Area to Perimeter Assessment

Study Area	Before Development	After Development
Northern Study Area	96	88
Southern Study Area	104	104

Proportional change in 'area to perimeter ratio' for the Northern and Southern Study Areas did not cross any specified BBAM 2014 thresholds. As such, both the Northern and Southern Study Area scored a 0 for the "Area to Perimeter" measure.

2.2.5 Landscape Score

Data for 'Percentage Native Vegetation Cover', 'Connectivity' and 'Patch Size' was combined to calculate a Landscape Score of 25 for the Northern Study Area. The same calculation procedure for the Southern Study Area resulted in a Landscape Score of 26. Marginal differences in the calculated Landscape Score exist between the Northern and Southern Study Areas.



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4. The aerial photography used in this plan has not been rectified. This image has been overlaid as a best fit on the boundaries shown and position is approximate only.

Legend

- Northern Linear Development Buffer (550m)
- Water Treatment Plant
- Residuals Transfer Pipeline
- Treated water transfer pipeline
- Excavated Channel
- Northern Study Area
- WTP Pipeline

TITLE : FIGURE 2: NORTHERN LINEAR DEVELOPMENT BUFFER (550M)	LOCATION : SPRINGVALE	DATUM:GDA 1994	DATE : 17/08/2016	VERSION (PLAN BY): B A3 (Natalie.Wood)
		PROJECTION: GDA 1994 MGA Zone 56	PURPOSE: BAR	PATH: J:\OBS\Centennial\All Jobs\131758 JV Energy Australia Springvale\10 - Drafting\Arcgis Map Documents\EcolBioBanking Figures\131758 Figure 2 NLDB BAR B A3 20160719.mxd

2.3 Assessing Native Vegetation

2.3.1 Native Vegetation Cover

Vegetation communities as mapped by DEC (2006) were reclassified using 'best fit' Plant Community Type (PCT) listed in the PCT Database (OEH 2016a) to describe vegetation zones. Parameters used to select the 'best fit' PCT included overstorey and understorey floristics, soil landscape, location and topographic position. **Table 5** lists the RPS mapped vegetation communities within the Study Area, as adapted from DEC (2006), and corresponding best fit PCTs. Threatened Ecological Community (TEC) equivalents are also provided.

Table 5 Regional Vegetation Types and PCT Equivalent

Vegetation Community (DEC 2006)	PCT	TEC
MU 7 Newnes Plateau Narrow-leaved Peppermint - Mountain Gum - Brown Stringybark Layered Forest	HN558 Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands	-
MU 8 Newnes Sheltered Peppermint - Brown Barrel Shrubby Forest	HN599 Sydney Peppermint - Narrow-leaved Peppermint shrubby open forest on sheltered slopes of the Newnes Plateau, Sydney Basin	-
MU 11 Tableland Gully Snow Gum - Ribbon Gum Montane Grassy Forest	HN572 Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands	<i>Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions</i>
MU 26 Newnes Plateau Narrow-leaved Peppermint - Silver-top Ash Layered Open Forest	HN600 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin	-
MU 28 Sandstone Plateau and Ridge Scribbly Gum - Silvertop Ash Shrubby Woodland	HN600 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin	-
MU 29 Sandstone Slopes Sydney Peppermint Shrubby Forest	HN600 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin	-
MU 33 Tableland Broad-leaved Peppermint - Brittle Gum - Red Stringybark Grassy Open Forest	HN514 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands	-
MU 35 Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest	HN590 Snow Gum - Mountain Gum tussock grass-herb forest of the South Eastern Highlands	-
MU 37 Cocks Permian Red Stringybark - Brittle Gum Woodland	HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highland	-
MU 43 Pagoda Rock Sparse Shrubland	HN508 Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin	-
MU 44 Sandstone Plateaux Tea Tree - Dwarf Sheoak - Banksia Rocky Heath	HN508 Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin	-

Vegetation Community (DEC 2006)	PCT	TEC
MU 53 Mountain Hollow Grassy Fen	HN602 Tableland swamp meadow on impeded drainage sites of the western Sydney Basin and South Eastern Highlands	<i>Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions</i>
MU 58 Acacia Thickets	HN 570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highland (Poor Condition)	-
MU 59 Non-native Vegetation – Pine Plantation / Woodlot / Shelter	Non- native vegetation	-
MU 62 Cleared/disturbed lands	Cleared/disturbed lands	-

Full descriptions of these PCTs are presented within the Biodiversity Inventory Report prepared for the Study Area (**Appendix 1**). Two of these PCTs are commensurate with EECs listed under the TSC Act.

2.3.2 Vegetation Zones

Vegetation Zones mapped in the Northern and Southern Study Areas are listed in **Table 6** and **Table 7** respectively and shown in **Figure 4**.

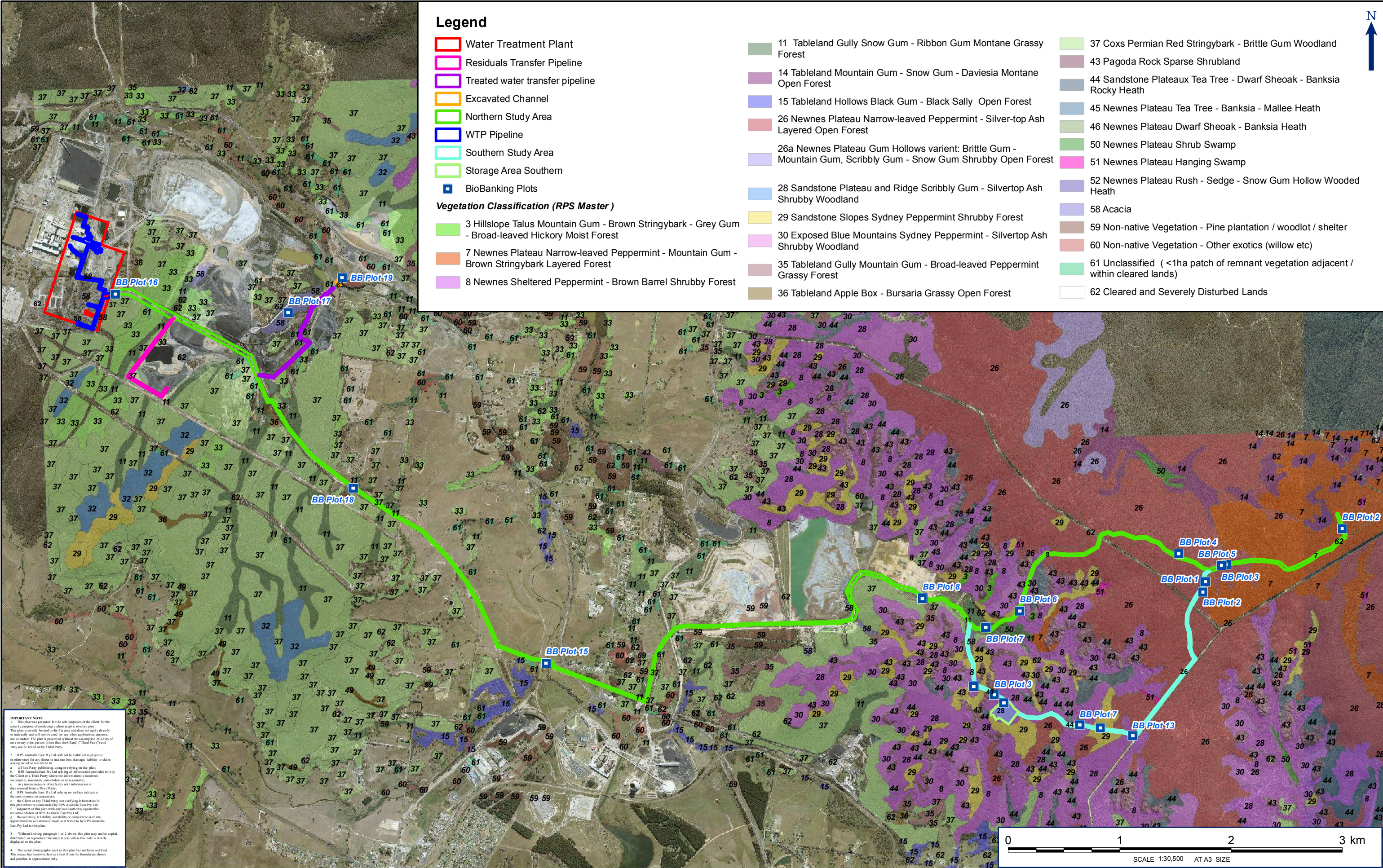
Table 6 Vegetation Zones – Northern Study Area

Veg Zone #	Vegetation Formation	PCT	Condition Class	Area (ha)	TEC	Cleared in Major Catchment Area (%)	Site Value Score
1	Dry Sclerophyll Forests (Shrubby subformation)	HN599	Moderate / Good	0.73	Not an EEC	30	64.58
2	Grassy Woodlands	HN572	Moderate / Good	0.63	Commensurate with an EEC	80	42.71
3	Grassy Woodlands	HN514	Moderate / Good	0.47	Not an EEC	80	53.62
4	Dry Sclerophyll Forests (Shrubby subformation)	HN600	Moderate / Good	1.71	Not an EEC	20	62.33
5	Freshwater Wetlands	HN602	Moderate / Good	0.02	Commensurate with an EEC	85	36.23
6	Dry Sclerophyll Forests (Shrubby subformation)	HN570	Moderate / Good_Poor	21.22	Not an EEC	55	40.62
7	Dry Sclerophyll Forests (Shrubby subformation)	HN570	Moderate / Good	1.49	Not an EEC	55	62.50
8	Wet Sclerophyll Forests (Shrubby subformation)	HN558	Moderate / Good	1.11	Not an EEC	30	61.63
10	Freshwater Wetlands	HN630	Moderate / Good	0.46	Not an EEC	70	31.88

Table 7 Vegetation Zones – Southern Study Area

Veg Zone #	Vegetation Formation	PCT	Condition Class	Area (ha)	TEC	Cleared in Major Catchment Area (%)	Site Value Score
1	Dry Sclerophyll Forests (Shrubby subformation)	HN599	Moderate / Good	0.19	Not an EEC	30	63.02
2	Grassy Woodlands	HN572	Moderate / Good	0.61	Commensurate with an EEC	80	36.98
3	Grassy Woodlands	HN514	Moderate / Good	0.47	Not an EEC	80	53.62
4	Dry Sclerophyll Forests (Shrubby subformation)	HN600	Moderate / Good	5.57	Not an EEC	20	50.69
5	Freshwater Wetlands	HN602	Moderate / Good	0.02	Commensurate with an EEC	85	36.23
6	Dry Sclerophyll Forests (Shrubby subformation)	HN570	Moderate / Good_Poor	21.45	Not an EEC	55	40.62
7	Dry Sclerophyll Forests (Shrubby subformation)	HN570	Moderate / Good	1.26	Not an EEC	55	62.50
8	Wet Sclerophyll Forests (Shrubby subformation)	HN558	Moderate / Good	1.24	Not an EEC	30	66.32
9	Heathlands	HN508	Moderate / Good	0.17	Not an EEC	5	48.07
10	Freshwater Wetlands	HN630	Moderate / Good	0.46	Not an EEC	70	31.88

Plot data for the Northern and Southern Study Areas is provided in **Table 8** and **Table 9** respectively.



TITLE : **FIGURE 4: VEGETATION ZONE AND PLOT LOCATIONS**

LOCATION : **SPRINGVALE**

DATUM:GDA 1994

DATE : **17/08/2016**

VERSION (PLAN BY): AA3 (Natalie.Wood)

PROJECTION: GDA 1994 MGA Zone 56

PURPOSE: **BAR**

PATH: J:\OBS\Centennial\All Jobs\131758 JV Energy Australia Springvale\10 - Drafting\Arcgis Map Documents\EcolBioBanking Figures\131758 Figure 4 Veg BB BAR B A3 20160721.mxd

Table 8 Survey Plot/Transect Data – Northern Study Area

Plot ID #	Plant Species Richness	Native Over-storey Cover	Native Mid Storey Cover	Native Ground Cover - grasses	Native Ground Cover - shrubs	Native Ground Cover - other	Exotic Plant Cover	# Tree Hollows	Overstorey Regeneration	Length Fallen Logs (m)	Easting (GDA 94-MGA 56)	Northing (GDA 94-MGA 56)
Veg Zone: – HN558 Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands (1 plots completed; minimum 1 plots required)												
BB02	34	54	2.5	68	10	44	0	3	0	45	235,372	6,302,312
Veg Zone: – HN599 Sydney Peppermint - Narrow-leaved Peppermint shrubby open forest on sheltered slopes of the Newnes Plateau, Sydney Basin (1 plots completed; minimum 1 plots required)												
BB06	34	44	26.5	80	8	80	0	4	0	18	232,455	6,301,617
Veg Zone: – HN572 Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands (1 plots completed; minimum 1 plots required)												
BB07	32	50.5	31.5	46	54	14	0	0	0	8	23,216	6,301,470
Veg Zone: – HN600 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin (3 plots completed; minimum 1 plots required)												
BB05	29	39	17.5	68	16	8	0	1	0	73	234,310	6,302,033
BB03	35	21.5	18	90	4	40	0	4	0	56	234,219	6,302,012
BB04	33	39	14	72	46	6	0	6	0	37	233,929	6,302,103
Veg Zone: – HN514 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands (1 plots completed; minimum 1 plots required)												
BB08	34	20	15	90	16	64	0	3	0	18	225,771	6,303,469
Veg Zone: – HN602 Tableland swamp meadow on impeded drainage sites of the western Sydney Basin and South Eastern Highlands (1 plots completed; minimum 1 plots required)												
BB04b	27	35	11	70	2	8	0	4	0	32	230,970	6,301,700
BB09	31	47	0	54	10	36	0	6	0	17	226,110	6,303,025
Veg Zone: – HN 570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highland (Poor Condition) (5 plot completed; minimum 4 plot required)												
BB16	17	17.5	0	66	2	18	4	0	0	0	224,335	6,304,465
BB17	19	11.5	0	48	6	10	2	0	0	0	225,887	6,304,298

Plot ID #	Plant Species Richness	Native Over-storey Cover	Native Mid Storey Cover	Native Ground Cover - grasses	Native Ground Cover - shrubs	Native Ground Cover - other	Exotic Plant Cover	# Tree Hollows	Overstorey Regeneration	Length Fallen Logs (m)	Easting (GDA 94-MGA 56)	Northing (GDA 94-MGA 56)
BB11	21	30	18	76	0	6	60	0	0	7	230,925	6,301,566
BB08b	19	0	13	30	2	26	58	0	0	1	231,582	6,301,728
BB20	11	0	26	34	18	2	24	0	0	0	224,200	6,304,511
Veg Zone: – HN630 <i>Phragmites australis</i> and <i>Typha orientalis</i> coastal freshwater wetlands of the Sydney Basin Bioregion (1 plot completed; minimum 1 plot required)												
BB19	1	0	92	0	0	0	50	0	1	0	226,324	6,304,562

Table 9 Survey Plot/Transect Data – Southern Study Area

Plot ID #	Plant Species Richness	Native Over-storey Cover	Native Mid Storey Cover	Native Ground Cover - grasses	Native Ground Cover - shrubs	Native Ground Cover - other	Exotic Plant Cover	# Tree Hollows	Overstorey Regeneration	Length Fallen Logs (m)	Easting (GDA 94-MGA 56)	Northing (GDA 94-MGA 56)
Veg Zone: – HN558 Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands (1 plots completed; minimum 1 plots required)												
BB002	34	54	2.5	68	10	44	0	3	0	45	235,372	6,302,312
BB001	26	27	21	70	20	36	0	2	0	16	234,126	6,301,881
Veg Zone: – HN599 Sydney Peppermint - Narrow-leaved Peppermint shrubby open forest on sheltered slopes of the Newnes Plateau, Sydney Basin (1 plots completed; minimum 1 plots required)												
BB12	35	55	46	22	54	44	0	2	0	43	232042	6,300,937
Veg Zone: – HN572 Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands (1 plots completed; minimum 1 plots required)												
BB18	20	28.5	13	74	10	8	38	0	0	0	226,473	6,302,720
Veg Zone: – HN600 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin (3 plots completed; minimum 1 plots required)												
BB006	33	39.5	16	4	56	42	0	5	0	51	233,182	6,300,568
BB05	29	39	17.5	68	16	8	0	1	0	73	234,310	6,302,033
BB03	35	21.5	18	90	4	40	0	4	0	56	234,219	6,302,012
BB002	33	33	16	26	28	22	0	3	0	66	234103	6301787
BB13	27	31.5	5.5	54	34	48	0	3	0	27	233469	6300497
BB14	18	28	25	80	8	54	0	5	0	11	232312	6300792
Veg Zone: – HN514 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands (1 plots completed; minimum 1 plots required)												
BB08	34	20	15	90	16	64	0	3	0	18	225,771	6,303,469
Veg Zone: – HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highland (2 plots completed; minimum 1 plots required)												
BB04b	27	35	11	70	2	8	0	4	0	32	230,970	6,301,700
BB09	31	47	0	54	10	36	0	6	0	17	226,110	6,303,025

Plot ID #	Plant Species Richness	Native Over-storey Cover	Native Mid Storey Cover	Native Ground Cover - grasses	Native Ground Cover - shrubs	Native Ground Cover - other	Exotic Plant Cover	# Tree Hollows	Overstorey Regeneration	Length Fallen Logs (m)	Easting (GDA 94-MGA 56)	Northing (GDA 94-MGA 56)
Veg Zone: – HN508 Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin (2 plots completed; minimum 1 plots required)												
BB03	20	3.5	25	2	32	32	0	0	0	29	232,227	6,300,864
BB07	30	14	24.5	6	44	32	0	2	0	15	232,992	6,300,595
Veg Zone: – HN602 Tableland swamp meadow on impeded drainage sites of the western Sydney Basin and South Eastern Highlands (1 plots completed; minimum 1 plots required)												
BB15	10	0	0	84	0	2	44	0	0	0	228,202	6,301,147
Veg Zone: – HN 570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highland (Poor Condition) (5 plot completed; minimum 4 plot required)												
BB16	17	17.5	0	66	2	18	4	0	0	0	224,335	6,304,465
BB17	19	11.5	0	48	6	10	2	0	0	0	225,887	6,304,298
BB11	21	30	18	76	0	6	60	0	0	7	230,925	6,301,566
BB08b	19	0	13	30	2	26	58	0	0	1	231,582	6,301,728
BB20	11	0	26	34	18	2	24	0	0	0	224,200	6,304,511
Veg Zone: – HN630 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (1 plot completed; minimum 1 plot required)												
BB19	1	0	92	0	0	0	50	0	1	0	226,324	6,304,562

2.4 Geographic and Habitat Features

Geographic and Habitat Features (GHFs) listed in **Table 10** and **Table 11** were selected in the BioBanking Credit Calculator as occurring within the Northern and Southern Study Areas respectively (i.e. incidence of broad non-PCT habitat features predicted by the BioBanking Credit Calculator). GHFs not occurring in the Study Area were not selected and were filtered out of the assessment.

Table 10 Geographic and Habitat Features – Northern Study Area (filtered)

Geographic and Habitat Feature	Species	
	Common name	Scientific name
land within 250 m of termite mounds or rock outcrops	Rosenbergs Goanna	<i>Varanus rosenbergi</i>
land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels	Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>
land within 500 m of sandstone escarpments with hollow-bearing trees, rock crevices or flat sandstone rocks on exposed cliff edges and sandstone outcropping	Broad-headed Snake	<i>Hoplocephalus bungaroides</i>
land within 40 m of heath, woodland or forest	Giant Burrowing Frog	<i>Heleioporus australiacus</i>
land above 800 m altitude in Wollemi CMA subregion	Bathurst Copper Butterfly	<i>Paralucia spinifera</i>
land within 100 m of stream or creek banks	Booroolong Frog	<i>Litoria booroolongensis</i>
heath or eucalypt forest on sandstone with a build-up of litter or other debris and containing, or within 40 m of, ephemeral or intermittent drainage lines	Red-crowned Toadlet	<i>Pseudophryne australis</i>
land within 100 m of emergent aquatic or riparian vegetation	Green and Golden Bell Frog	<i>Litoria aurea</i>

Table 11 Geographic and Habitat Features – Southern Study Area (filtered)

Feature	Species	
	Common Name	Scientific Name
land within 250 m of termite mounds or rock outcrops	Rosenbergs Goanna	<i>Varanus rosenbergi</i>
land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels	Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>
land within 500 m of sandstone escarpments with hollow-bearing trees, rock crevices or flat sandstone rocks on exposed cliff edges and sandstone outcropping	Broad-headed Snake	<i>Hoplocephalus bungaroides</i>
land within 40 m of heath, woodland or forest	Giant Burrowing Frog	<i>Heleioporus australiacus</i>
land above 800 m altitude in Wollemi CMA subregion	Bathurst Copper Butterfly	<i>Paralucia spinifera</i>
land within 100 m of stream or creek banks	Booroolong Frog	<i>Litoria booroolongensis</i>
heath or eucalypt forest on sandstone with a build-up of litter or other debris and containing, or within 40 m of, ephemeral or intermittent drainage lines	Red-crowned Toadlet	<i>Pseudophryne australis</i>
land within 100 m of emergent aquatic or riparian vegetation	Green and Golden Bell Frog	<i>Litoria aurea</i>
rainforest or tall open wet forest with understorey and/or leaf litter and within 100 m of streams	Stuttering Frog	<i>Mixophyes balbus</i>

3.0 Threatened Species

The Threatened Species Profile Database (TSPD) (OEH 2016b) classifies threatened species into two credit types; 'Ecosystem Credit' and 'Species Credit' type species. Threatened species aggregated into the Ecosystem Credit class represent those with habitat requirements that can be predicted using PCTs as habitat surrogates. Impacts on these threatened species are treated at a vegetation zone level and do not attract individual species credit requirements.

Conversely, Species Credit species are those with habitat needs that are not reliably predicted by PCT and/or location (e.g. predicted using GHF). Only Species Credit species require targeted surveys and attract individual species specific offset requirements. However, it should be noted that some species have a dual classification (i.e. have both ecosystem and species credit class). For example, Species Credits for specific areas of 'breeding habitat' (e.g. roost sites for cave microbats) as opposed to ecosystem credits that apply to the foraging habitat for the same species.

The 'Tg' value for a threatened species is a representation of a species' life history characteristics, rarity, and the amount of information available on the species. The 'Tg' value of both ecosystem and species type species weights the significance of habitat and in the case of ecosystem credit type species the species with the highest 'Tg' value is applied to the site. In certain circumstances, the 'Tg' value can be modified by the assessor to better characterise the value or importance of a site for an individual species.

The following sections discuss these aspects of the assessment including any use of judgement.

3.1 Ecosystem Credit Species

The 'Site Survey details' section of the Credit Calculator lists a total of 13 Ecosystem Credit type species with potential to occur within the Study Area. These are listed in **Table 12** along with recorded incidence.

Table 12 Predicted Ecosystem Type Species

Common Name	Scientific Name	Recorded Within 10km (NSW Wildlife Atlas 2015)	Recorded in Northern Study	Recorded in Southern Study Area
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus subsp. victoriae</i>	Y	Y	Y
Diamond Firetail	<i>Stagonopleura guttata</i>	Y	N	N
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	Y	N	N
Flame Robin	<i>Petroica phoenicea</i>	Y	N	N
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	Y	Y	Y
Glossy Black-Cockatoo	<i>Calyptrorhynchus lathamii</i>	Y	Y	Y
Little Eagle	<i>Hieraaetus morphnoides</i>	Y	Y	Y
Little Lorikeet	<i>Glossopsitta pusilla</i>	Y	N	Y
Powerful Owl	<i>Ninox strenua</i>	Y	Y	N
Scarlet Robin	<i>Petroica boodang</i>	Y	Y	Y
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	Y	N	N
Varied Sittella	<i>Daphoenositta chrysoptera</i>	Y	N	N
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	Y	Y	Y

3.2 Species Credit Species

3.2.1 Threatened Species Survey Methodologies

A comprehensive understanding of the biodiversity values has been obtained over several seasons and years for the Study Area (**Appendix 1**, RPS 2011, RPS 2012, RPS 2014a RPS 2014b and RPS 2016). This information was used to populate the 'Site Survey details' data entry portal of the Biobanking Credit Calculator. **Table 13** and **Table 14** list 18 'Species Credit' species with potential to occur within the Study Area. Recorded incidence is noted. 'Assumed presence' is noted where scientific uncertainty exists.

Table 13 Species Credit Species within Northern Study Area

Common Name	Scientific Name	Recommended Survey Period	Targeted survey Y/N	Recorded in Study Area Y/N	Assumed Presence Y/N
Bathurst Copper Butterfly	<i>Paralucia spinifera</i>	All year round	Y	N	N
Black Gum	<i>Eucalyptus aggregata</i>	February-December	Y	N	N
Booroolong Frog	<i>Litoria booroolongensis</i>	November - February	Y	N	N
Broad-headed Snake	<i>Hoplocephalus bungaroides</i>	March - November	Y	N	N
Capertee Stringybark	<i>Eucalyptus cannonii</i>	All year round	Y	N	Y
Clandulla Geebung	<i>Persoonia marginata</i>	All year round	Y	N	N
<i>Veronica blakelyi</i>	<i>Veronica blakelyi</i>	All year round	Y	Y	N
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	None specified	None specified	N	N
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	September - May	Y	N	N
Green and Golden Bell Frog	<i>Litoria aurea</i>	August - March	Y	N	N
<i>Grevillea divaricata</i>	<i>Grevillea divaricata</i>	All year round	Y	N	N
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	September - April	Y	Y	N
Red-crowned Toadlet	<i>Pseudophryne australis</i>	All year round	Y	N	N
Regent Honeyeater	<i>Anthochaera phrygia</i>	All year round	Y	N	N
Rosenbergs Goanna	<i>Varanus rosenbergi</i>	November - February	Y	N	N
Silver-leafed Gum	<i>Eucalyptus pulverulenta</i>	All year round	Y	N	N
Squirrel Glider	<i>Petaurus norfolcensis</i>	All year round	Y	N	N
Thick-leaf Star-hair	<i>Astrotricha crassifolia</i>	All year round	Y	N	N

Table 14 Species Credit Species within Southern Study Area

Common Name	Scientific Name	Recommended Survey Period	Targeted Survey Y/N	Recorded in Study Area Y/N	Assumed Presence Y/N
Bathurst Copper Butterfly	<i>Paralucia spinifera</i>	All year round	Y	N	N
Black Gum	<i>Eucalyptus aggregata</i>	February-December	Y	N	N
Booroolong Frog	<i>Litoria booroolongensis</i>	November - February	Y	N	N
Broad-headed Snake	<i>Hoplocephalus bungaroides</i>	March - November	Y	N	N
Capertee Stringybark	<i>Eucalyptus cannonii</i>	All year round	Y	N	Y
Clandulla Geebung	<i>Persoonia marginata</i>	All year round	Y	N	N
<i>Veronica blakelyi</i>	<i>Veronica blakelyi</i>	All year round	Y	N	N
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	None specified	None specified	N	N
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	September - May	Y	N	N
Green and Golden Bell Frog	<i>Litoria aurea</i>	August - March	N	N	N
<i>Grevillea divaricata</i>	<i>Grevillea divaricata</i>	All year round	Y	N	N
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	September - April	N	Y	N
Red-crowned Toadlet	<i>Pseudophryne australis</i>	All year round	Y	N	N
Regent Honeyeater	<i>Anthochaera phrygia</i>	All year round	Y	N	N
Rosenbergs Goanna	<i>Varanus rosenbergi</i>	November - February	N	N	N
Silver-leafed Gum	<i>Eucalyptus pulverulenta</i>	All year round	Y	N	N
Squirrel Glider	<i>Petaurus norfolcensis</i>	All year round	Y	N	N
Thick-leaf Star-hair	<i>Astrotricha crassifolia</i>	All year round	Y	N	N

A small portion of the Southern Study Area was surveyed outside of the recommended survey period for species identified in bold. However, this is not of concern in this assessment for the following reasons:

- The weather conditions experienced during the most recent survey were unusually warm and generally suitable for the species indicated (see **Appendix 1**).
- Faunal habitats of Southern Study Area are contiguous with the Northern Study Area where adequate surveys have been performed. Results for the Northern Study Area are transferrable on this basis.

Numerous flora and fauna surveys were conducted across similar adjoining habitats within the Springvale Project Application Area (RPS 2011, RPS 2012, RPS 2014a, RPS 2014b, RPS 2014c and RPS 2016) and associated monitoring programs. Results are transferrable on this basis.

3.2.2 Species Polygons

A species polygon has been mapped for Species Credit species with known or potential incidence within the Study Area. The details are provided in the following sections.

3.2.2.1 Northern Study Area

Four 'Species Credit' Species have been recorded within the Northern Study Area. These include three threatened flora (*Veronica blakelyi*, *Persoonia hindii* and *Caesia parviflora* var. *minor*) and one threatened mammal (Large-eared Pied Bat). Only one threatened species polygon is required for the Northern Study Area as Species Credits for flora are calculated using the number of individuals.

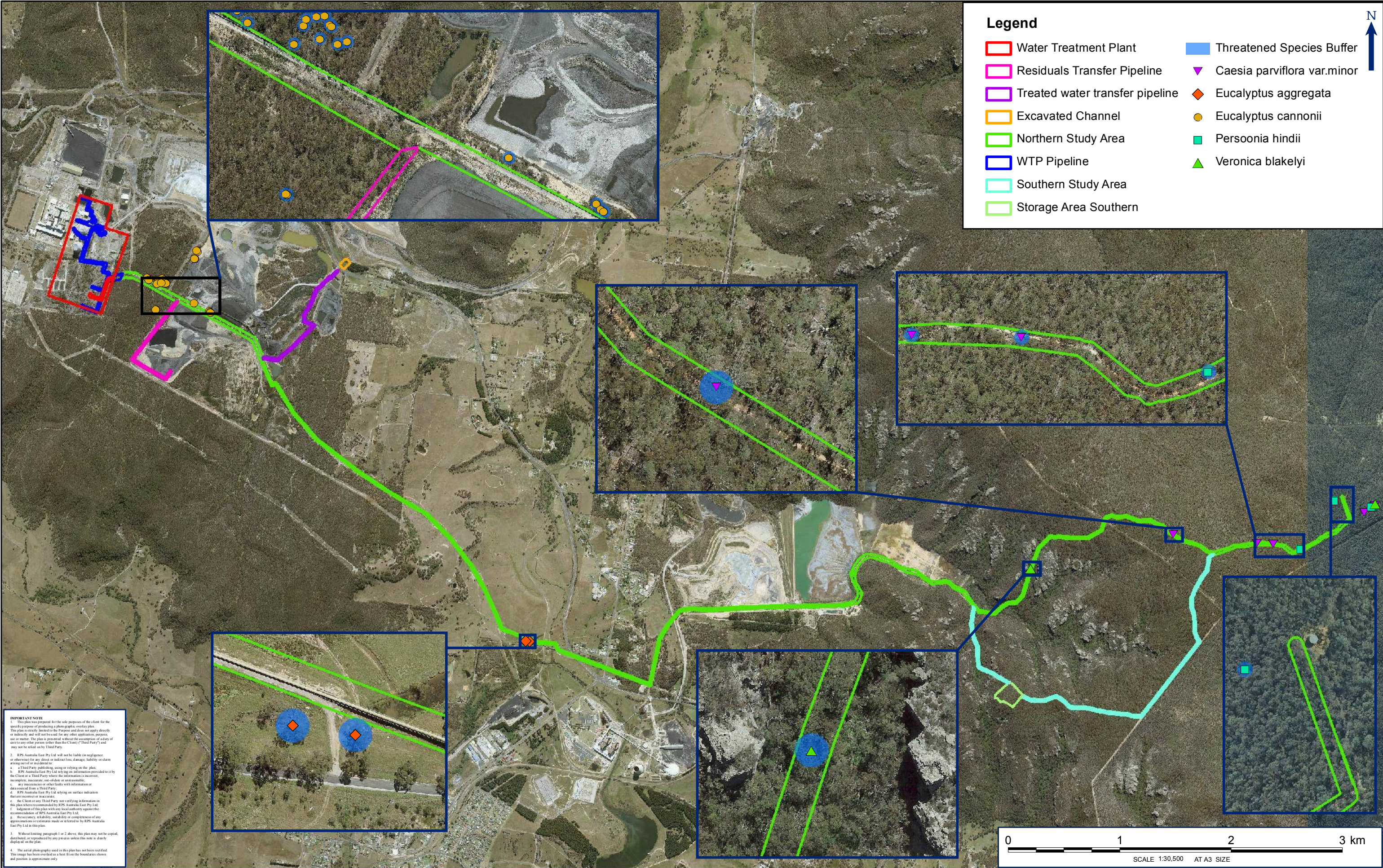
The Large-eared Pied Bat is considered to have suitable habitat within the Study Area. Sandstone cliffs located in close proximity to fertile valley woodlands (i.e. important foraging habitat) is considered habitat critical to the survival of the Large-eared Pied Bat (DECC 2007). The threatened species polygon mapped for this species is coincident HN599 (Sydney Peppermint - Narrow-leaved Peppermint shrubby open forest on sheltered slopes of the Newnes Plateau, Sydney Basin) and HN508 (Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin) and is shown in **Figure 5**.

3.2.2.2 Southern Study Area

Three 'Species Credit' Species have been recorded within the Southern Study Area. These include two threatened flora (*Persoonia hindii* and *Caesia parviflora* var. *minor*) and one threatened mammal (Large-eared Pied Bat). As outlined for the Northern Study Area, only one threatened Species polygon is produced for the Southern Study Area and is shown in **Figure 5**.

3.3 Identified Populations

The Director General of OEH may develop an 'Identified Populations' Database that identifies population(s) of threatened species present in an area of land that require assessment under the BBAM (either for a Biobank or development site). To date, the BBAM has not determined any 'Identified Populations'. The Director General of OEH may develop an 'Identified Populations' Database that identifies population(s) of threatened species present in an area of land that require assessment under the BBAM (either for a Biobank or development site). To date, the BBAM has not determined any 'Identified Populations'.



TITLE : FIGURE 5: THREATENED SPECIES POLYGONS – DISTURBANCE AREA	LOCATION : SPRINGVALE	DATUM:GDA 1994	DATE : 17/08/2016	VERSION (PLAN BY): B A3 (Natalie.Wood)
		PROJECTION: GDA 1994 MGA Zone 56	PURPOSE: BAR	PATH: J:\JOBS\Centennial\All Jobs\131758 JV Energy Australia Springvale\10 - Drafting\Arcgis Map Documents\EcolBioBanking Figures\131758 Figure 5 THSP BAR B A3 20160719.mxd

Stage 2 – Impact Assessment (Biodiversity Values)

4.0 Potential Impacts

The Project has incorporated impact avoidance and minimisation strategies, where possible, to minimise direct and/or indirect impacts on biodiversity values (e.g. presence of threatened species and TECs) and activation of Key Threatening Processes (KTPs). Impact avoidance and minimisation strategies are outlined in the following sections.

4.1 Impact Avoidance

Impact avoidance aims to minimise impacts on threatened species and ecological communities primarily through alteration in the design of a Project. Avoidance of potential impacts has been achieved in the first instance through the preferential use of existing disturbance areas such as pipelines and tracks. Relevant impact avoidance considerations are discussed in **Table 15**.

Table 15 Impact Avoidance Considerations

Biodiversity Value	Northern versus Southern Study Areas
Native vegetation	The clearing of native vegetation within the Northern Project area would result in at least 3.60 ha being avoided by comparison to the Southern Study Area.
Hollow-bearing trees	A total of 67 hollow-bearing trees were identified in the Northern Study Area compared with 149 hollow-bearing trees within the Southern Study Area. The loss of hollow-bearing trees is a KTP. The greater loss of hollow-bearing trees would have a greater impact on the Glossy-black Cockatoo, Powerful Owl, Varied Sittella, Brown Tree-creeper and microchiropteran bats.
Threatened species	The Northern Study Area would result in a greater impact on threatened species than the Southern Study Area. Additional <i>Caesia parviflora</i> ssp. <i>minor</i> and <i>Veronica blakelyi</i> would be impacted within the Northern Study Area. A large, pure stand of <i>Allocasuarina littoralis</i> utilised by the Glossy-black Cockatoo occurs in the Southern Study Area. No impacts of this nature would occur within the Northern Study Area. Sandstone escarpment suitable for the Large-eared Pied Bat occurs in the Southern Study Area. No such sandstone escarpment occurs within the Northern Study Area, although occurs in close proximity to the alignment. Foraging habitat for this species occurs within both the Northern and Southern Study Areas. Potential Powerful Owl roost trees occur on both the Northern and Southern Study Areas, with the Powerful Owl observed in the Northern Study Area.
Threatened Ecological Communities	The Northern Study Area would result in the loss of 0.63 ha of Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions EEC compared with a 0.61 ha loss of the same EEC in the Southern Study Area.
Groundwater Dependant Ecosystems	Neither Study Area has a greater impact on GDEs.
Patch integrity	The Southern Study Area is expected to have a lower impact on patch integrity as the pipeline is proposed to align with existing areas of disturbance (i.e. existing pipeline/ tracks), thus reduce the total amount of native vegetation loss. Impacts within the Northern Study Area would require the establishment of a new pipeline easement requiring new disturbance areas that are additional to those required for the Southern Study Area.

It is evident from an analysis of information provided in **Table 15** that the Southern Study Area would likely have a greater impact on biodiversity despite the larger impact on TECs and additional edge effects predicted in the Northern Study Area.

4.2 Impact Minimisation

Both the Northern and Southern Study Areas would result in the removal of threatened plant species and hollow-bearing trees. However, by observing careful construction techniques through the course of Project

construction (i.e. use of pre-clearance surveys and minor route adjustment), opportunity exists to avoid impacts on individual threatened plants and hollow-bearing trees.

The benefit of this impact minimisation strategy is not currently known as site specific construction constraints are likely to have an important role in determining the efficacy of this strategy. As such, it is not possible to conclusively say that all threatened species and hollow-bearing trees would be avoided. Impact assumptions adopted on this basis are listed below:

- Zero loss of *P. hindii* (averting the loss of seven observed individuals);
- Three individuals of *C. parviflora* var. *minor*; and
- Three individuals of *E. cannonii*.

The above impact assumptions would be confirmed prior to construction through the completion of pre-clearance surveys to validate offsetting requirements.

4.3 Mitigation

Mitigation measures for the Project are to be implemented through a Construction Environmental Management Plan (CEMP). The following mitigation measures are recommended for inclusion in the CEMP to reduce the impacts of clearing, construction and operation of the proposed development:

- The clearing of native vegetation should be minimised as far as is practicable. Unnecessary vegetation clearing should be minimised by fencing the clearing limit.
- All contractors will be specifically advised of the designated work area. The following activities are not to occur outside of designated work areas to minimise impacts on native vegetation:
 - » Vehicle movements;
 - » Storage and mixing of materials;
 - » Vehicle parking;
 - » Liquid disposal;
 - » Machinery repairs and/or refueling;
 - » Combustion of any material;
 - » Inappropriate stockpiling of soil, rubble or debris; and/or
 - » Any filling or excavation including trenching, topsoil skimming and/or surface excavation.
- All construction and operational vehicles/machinery will use designated access tracks. Speeds will be limited to 20 kilometres per hour to reduce the potential of fauna strike and to reduce dust generation.
- Plant and machinery will be cleaned of any foreign soil and propagative material prior to being transported to the construction areas to prevent the spread of weeds and potential importation of Phytophthora.
- If machinery is transported from an area of confirmed infection of Phytophthora or Chytrid fungus to the construction areas, stringent wash down will be completed before leaving the area, removing all soil and vegetative material from cabins, trays, and under carriages.
- To minimise potential impacts on adjacent conservation lands and wetland habitats all liquids (fuel, oil, cleaning agents, drilling liquids etc.) will be stored appropriately and disposed of at suitably licensed facilities. Spill management procedures will be implemented as required. Rubbish will be collected and removed from the Project Application area.
- Appropriate erosion and sediment control measures will be managed via the implementation of an erosion and sediment control plan, in accordance with best management practices, such as the:

- » Best Practice Erosion and Sediment Control Guidelines (IECA, 2008); and
- » Managing Urban Stormwater: Soils and Construction 4th Ed. 'The Blue Book' (Landcom 2004).

It is imperative that the plan ensures that any offsite discharge of stormwater (freshwater) does not significantly impact upon the adjoining aquatic environments.

- Construction personnel will be trained adequately in pest management and hygiene procedures.
- Weed management procedures will be implemented to prevent the spread of weeds both inside the Project Application Area and outside. Ongoing weed monitoring to be implemented and potential weed infestations appropriately managed to minimise the spread of weeds on the Project area. Management of noxious weeds are to be undertaken in accordance with the *Noxious Weeds Act* 1993. Weed monitoring should occur throughout the construction and operation phase and weed removal will be carried out as necessary.
- Where possible, clearing activities should be timed to avoid removal of hollow-bearing trees during breeding season of threatened species (avoiding winter and spring).
- An ecologist is to perform pre-clearance surveys with the construction manager to identify key areas of impact avoidance including threatened plant species. Impact assessment assumptions for threatened plant loss are to be validated through this pre-clearance survey.
- A qualified ecologist is to be present to supervise hollow-bearing tree clearing within the Project Application Area and that vegetation clearing is undertaken in the following manner:
 - » Hollow-bearing trees are to be clearly marked (spray paint or flagging tape) within the disturbance footprint prior to any vegetation clearing commencing.
 - » Non habitat vegetation should be removed at least one day prior to felling of hollow-bearing trees to encourage resident fauna to self relocate before felling of remaining habitat trees.
 - » Immediately prior to the felling of hollow-bearing trees, trees should be given two sharp taps with the machinery arm/bucket to encourage fauna to escape. After waiting 1–2 minutes after tapping the tree, the hollow-bearing tree should be felled as gently as possible.
 - » An ecologist is to inspect each felled hollow-bearing tree (once safe) to recover any injured fauna and seek appropriate treatment, and relocate uninjured fauna into vegetation to be retained within the Project Application Area.
 - » Felled timber is to be left in place for one night after all other vegetation is removed to allow any remaining fauna to vacate hollows.

4.4 Direct Impacts

The Project's direct impacts are discussed in the following sections. Direct impacts are calculated using a 10 m wide construction area plus additional infrastructure footprints where described in **Section 1.1**.

4.4.1 Vegetation Loss

Native vegetation loss in the Northern and Southern Study Areas is quantified in **Table 16**. The least impact on native vegetation is within the Northern Study Area with the net difference in native vegetation loss being 3.60 ha.

Table 16 Native vegetation loss within the Northern and Southern Study Areas

Vegetation Community	Northern (ha)	Southern (ha)
HN508 Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin	0.00	0.17
HN514 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands	0.47	0.47
HN558 Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands	1.11	1.24
HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highland	1.49	1.49
HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highland (Poor Condition)	21.22	21.22
HN572 Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands	0.63	0.61
HN599 Sydney Peppermint - Narrow-leaved Peppermint shrubby open forest on sheltered slopes of the Newnes Plateau, Sydney Basin	0.73	0.19
HN600 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin	1.71	5.57
HN602 Tableland swamp meadow on impeded drainage sites of the western Sydney Basin and South Eastern Highlands	0.02	0.02
HN630 <i>Phragmites australis</i> and <i>Typha orientalis</i> coastal freshwater wetlands	0.46	0.46
Total	27.84	31.44

*Cleared/disturbed lands have been ground-truthed and where they contain vegetation they may be considered as 'vegetation in low condition' (OEH 2014b). However, the temporary nature of the trenching and the subsequent re-vegetating is not considered to yield a net loss of this predominantly exotic and disturbed vegetation type within the Study Area. Consequently, this vegetation type has been omitted from the credit calculations.

4.4.2 Flora

Three threatened flora species (*Caesia parviflora* var. *minor*, *Persoonia hindii* and *Veronica blakelyi*) were recorded within the Northern and Southern Study Areas. *Persoonia hindii* and *Veronica blakelyi* are both easily detected throughout the year and as such it is considered that survey results would produce an accurate impact estimate for these species. Impact avoidance measures are proposed for *Persoonia hindii* or *Veronica blakelyi* specimens.

The endangered herb *Caesia parviflora* var. *minor* was also identified within both the Northern and Southern Study area (n=3), with two specimens observed in the eastern 'in common' section. Notwithstanding, it should be noted that survey timing for this species along the Southern Study Area was outside the flowering period and as such is likely to have underestimated impacts on this species for this part of the Study Area.

Potential habitat is present for *Lastreopsis hispida* within the moist sheltered gully habitat of MU 8 Newnes Sheltered Peppermint - Brown Barrel Shrubby Forest. This vegetation community was recorded along both the Northern and Southern Study Areas. The groundcover of this vegetation community was dominated by ferns including *Pteridium esculentum* and *Blechnum nudum*. However, this species was not detected despite the undertaking of appropriately timed targeted surveys. Impacts on this species and its habitat are expected to be negligible.

Suitable habitat for *Acacia bynoeana* occurs throughout the Newnes Plateau. If present, it is likely that a local population would extend throughout the heaths and woodlands that occur on sandy soils. No specimens of

this species were observed despite the performing of appropriately timed targeted surveys. Impacts on this species and its habitat are expected to be negligible.

Genoplesium superbum has been recorded within one location within 10 km of the Study Area. The habitat of the local occurrence of this species can be generally described as shrubby woodland on a slope. Habitats within the Study Area therefore have potential to support this species. If present, there is a high likelihood that a local population would extend outside the Study Area, given the large areas of commensurate habitat in the surrounding landscape. No specimens of this species were observed despite the performing of appropriately timed targeted surveys. Impacts on this species and its habitat are expected to be negligible.

4.4.3 Fauna

The Study Area does not include expansive areas of particularly rocky habitats, such as large rock platforms or cliffs, however it will pass through some areas considered suitable for the Broad-headed Snake. Caves or similar structures that may be used by cave dwelling microbats were recorded in close proximity to the Study Area. No loss of caves or similar structures is expected as a consequence of the Project.

The loss of mid-storey and canopy trees would remove nesting and foraging habitat for threatened bird species, as well as foraging habitats for threatened arboreal mammals, microbats and hunting habitat for the Broad-headed Snake. Specific foraging habitat niches within the proposed surface infrastructure footprint include *Banksia* species used by the Eastern Pygmy Possum, *Allocasuarina* species used by Glossy Black-Cockatoos and nectar producing trees and shrubs used by nectivorous birds and mammals. A primary Koala feed tree (*E. viminalis*) only occurs within a small section of the alignment. This feed tree is a component of MU 11 only and is thus not abundant within the northern Study Area. Therefore, the Koala is unlikely to be impacted by the Project.

Tree hollows recorded included some of sufficient size to support roosting of large forest owls and cockatoo species. The Project will therefore result in a loss to potential roosting or nesting trees for the Gang-Gang Cockatoo, Glossy Black-Cockatoo and threatened owls. It is noted, however, that the threatened Barking Owl, Powerful Owl and Masked Owl have specific preferences regarding hollow types, which involve hollows developing from the main stem of the tree. These hollows are less prevalent; however one suitable hollow was detected in MU 8 of the Northern Study Area. The Sooty Owl prefers moist tall forests, thus meaning there is small amount of preferred habitat for this species.

No potential breeding habitat would be removed for the Giant Burrowing Frog, Red-crowned Toadlet or Littlejohn's Tree Frog. However, the Project will run alongside an ephemeral drainage line for approximately 1 km. The proposed clearing may therefore cause a loss of potential foraging habitat for these species.

The eastern portion of the Northern Study Area is surrounded by large areas containing contiguous forest, woodland, heath, swamp and rocky habitats. These habitats continue throughout the Newnes State Forest and into the Gardens of Stone National Park, Blue Mountains National Park and Wollemi National Park. The local populations of species with high mobility, such as threatened birds, bats, arboreal mammals and terrestrial mammals would continue into these surrounding areas.

4.4.4 Groundwater Dependent Ecosystems

As discussed in **Appendix 1**, MU 53 may have some degree of dependence on groundwater for its ecological function and therefore may constitute a GDE. The Project would result in the removal of 0.02 ha of this vegetation with the post developed landscape allowing the potential rehabilitation of this vegetation. Limited potential exists for this impact to adversely affect adjoining areas of this vegetation over the medium to long term, although it is recognised that short term impacts may occur.

4.5 Indirect Impacts

Indirect impacts associated with the Project may include:

- Fragmentation;
- Introduction of exotic flora and fauna species;
- An increase in runoff from disturbed areas of land; and
- Hydrocarbons pollution from construction activities (e.g. oil spills).

The following sections discuss the potential indirect impacts associated with the Project.

4.5.1 Edge Effects

The 'edge effect' describes a collection of factors and processes that influence the presence and abundance of species at a boundary, whether they are natural boundaries (e.g. ecotones) or a disturbance of some kind (e.g. cleared lands). Edges can occur naturally within ecosystems and include situations such as the common boundary between two ecological communities (i.e. ecotones) or the boundary between burnt and unburnt vegetation.

Bali (2005) identifies the following main factors and processes that operate at a disturbed edge of an ecological community:

- Microclimate (e.g. localised changes in temperature, wind, light, humidity).
- Hydrology (i.e. localised changes in surface and subsurface water flows).
- Altered fire frequency and intensity.
- Invasion by exotic plant and animal species.
- Alteration of soil conditions (e.g. increased sedimentation and nutrient availability).
- Alteration of vegetation structure (e.g. tree death and increased shrub densities).

While biodiversity, as a collective, can adapt to the effects of an edge, some species are partially or wholly reliant on edge effects; thus resulting in 'winners' and 'losers' in such circumstances. Species that benefit from edges are generally characterised as pioneer species, a category that often includes many exotic/ weed species. Native plant species of this classification include wattles and many grasses.

On average, edge effects have been estimated to occur up to 50 metres from a road edge (Bali 2005), although much greater distances have been recorded in some road studies (Forman et al. 2003). Edge effects are particularly pronounced in patches where a large edge to area ratio exists (i.e. small vegetation patches with a proportionally large perimeter). Such conditions often result in the simplification of biodiversity values in favour of generalists or edge specialist species. These impacts already exist in the smaller more isolated vegetation patches of the study area. The Project is unlikely to have any substantial incremental edge effects on these smaller isolated patches over and above existing conditions.

Edge effects can influence ecological process by altering the flows of energy, moisture, temperature, materials or organisms and by providing access to spatially separated resources (Fletcher et al. 2007). In turn, this indirectly leads to changes in population structure, species interaction and community structure near edges (Fletcher et al. 2007).

The greatest potential for indirect impacts on native vegetation and habitat is in areas where the Project traverses through large stands of vegetation. Such impacts are either new (i.e. Northern Study Area) or

associated with the shifting of edge effects into vegetation previously unaffected by these impacts (i.e. Southern Study Area). Potential edge effects in these areas may include:

- Establishment of weeds along boundaries between native vegetation and cleared lands and potential for weed incursions into adjacent native vegetation;
- Modification of habitat attributes, through increased light and noise levels, and changes to vegetation structure, soil nutrient levels and plant species diversity;
- Changes to fauna assemblages, including alteration of woodland and forest bird assemblages by edge specialists;
- Increased predation of birds, small mammals, reptiles and frogs by species that use forest edges for foraging; and
- Increased nest predation of small insectivorous birds at forest edges.

Although the area to be cleared is not likely to fragment two or more patches of vegetation, it will increase the available edges for ecological changes to occur. “New road works through bushland will increase sunlight and air temperature, which raises soil temperature and decreases soil moisture. This may prevent seeds of shade-tolerant species from germinating and favour other place species (i.e. those that thrive on increased light)” (Rowley et al. 1999:1). Additionally, vehicles utilising this road network have the potential to spread exotic flora species that will have an increased surface area in which to establish themselves.

4.5.2 Fragmentation

Fragmentation is the process of reducing what was once a continuous area of vegetation or habitat into smaller divided and discrete patches of vegetation in isolation. Fragmentation of landscapes reduces a species' ability to adapt to climatic conditions. Many fauna species are implicated by the process of fragmentation, including experiencing severe population declines (Robertson and Radford 2009). The overall ecology of fragmented patches may be detrimentally altered, which influences flora and fauna assemblages (Lindenmayer et al. 1999).

Indirectly, fragmentation can put stress on native flora and fauna by increasing the amount of competition for resources and space of remaining fragments (Fischer and Lindenmayer 2007). Direct clearing can impact immobile organisms such as plants (and also mobile organisms that do not escape efficiently) leaving mobile animals to traverse to other surrounding environments that could be smaller remnants. This can result in overcrowding of an already overpopulated patch, interbreeding, and increased competition (Fischer and Lindenmayer 2007).

Seed dispersal for flora is also not expected to be hindered by the areas of clearing. Although the area of direct occupancy will be reduced marginally for a select few species that exist within the surface infrastructure footprint, they are not expected to be restricted in their ability to disperse naturally within the immediate surrounding environments.

4.5.3 Exotic Flora

There is the potential for the introduction of weeds where the Project traverses intact stands of native vegetation. Further, without the use of appropriate weed management protocols, the Project has the potential to facilitate the spread of weeds into adjoining native vegetation. Mitigation measures to be implemented during the construction and operational phases of the Project are recommended to manage and control the incidence and effect of noxious and environmental weeds on the receiving environment. Matters at greatest risk of being impacted by this factor are EECs and threatened flora species.

4.5.4 Noise

Vehicle, plant and construction equipment used to install the Project would temporarily increase noise pollution within the Project area. This can cause disruption to normal fauna activity and often lead to the departure of species from an area. No operational noise is expected. Short term non-permanent impacts through the construction period are expected with impacts limited to highly mobile species such as woodland birds (e.g. Regent Honeyeater, Scarlet Robin and Varied Sittella).

4.5.5 Runoff

The removal of vegetation, including both trees and grasses will increase the risk of storm-water run-off. Operational activities also increase pollution risk within the environment, specifically the spillage of mine water. Matters at greatest risk of being impacted by this indirect impact are threatened plant species and EECs.

4.5.6 Vehicle Strike

The Project would, in places, establish a temporary trafficable surface for vehicles through areas of native vegetation thus increasing the exposure of fauna to a vehicle hazard. As a consequence, it is considered that the risk of fauna being struck by vehicles would increase. Vehicle movements would be during the day and would be controlled by speed limits imposed by construction management and actual conditions. Fauna species considered most at risk of this impact are slow moving species such as reptiles and amphibians. Nocturnal species are unlikely to be impacted by the construction traffic.

4.6 Key Threatening Processes

Key Threatening Processes (KTPs) are listed under Schedule 3 of the TSC Act. There are five KTPs that have the potential to affect the study area as a consequence of the Project, being:

- Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners (*Manorina melanocephala*);
- Loss of hollow-bearing trees;
- Removal of dead wood and dead trees;
- Clearing of native vegetation;
- Anthropogenic climate change;
- Degradation of native riparian vegetation along NSW watercourses; and
- Invasion of native plant communities by exotic perennial grasses.

“Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners (*Manorina melanocephala*)”

The removal of approximately 27.84 of native vegetation in the Study Area may contribute to an increased dispersal of Noisy Miners into surrounding vegetation. However, whilst the Project may increase their dispersal, it is unlikely, given the heavy vegetated condition of surrounding areas, that Noisy Miners will exhibit high abundance and aggressive behaviour within the study area or locality.

“Loss of hollow-bearing trees”

The Project will require the removal of between 67 hollow-bearing trees and as such will contribute to the KTP “Removal of Hollow-bearing Trees”. In this respect it is considered that the Project area with the least impact on hollow-bearing trees be selected as the preferred pipeline path (i.e. Northern Study Area). The

avoidance of hollow-bearing trees during construction is recommended to minimise impacts on this habitats feature.

“Removal of dead wood and dead trees”

The removal of approximately 27.84 of native vegetation in the Study Area would result in the removal of dead trees or ground debris and as such will contribute to the KTP “Removal of Dead Wood and Dead Trees”. The avoidance/ relocation of dead wood and trees during construction are recommended to minimise impacts on this habitats feature.

“Clearing of Native Vegetation”

The removal of approximately 27.84 of native vegetation in the Study Area would contribute to the KTP “Clearing of Native Vegetation”. In this respect it is considered that the least impact on native vegetation is within the Northern Study Area.

“Anthropogenic Climate Change”

The removal of approximately 27.84 of native vegetation in the Study Area would reduce the bioaccumulation of CO₂ thus aid in atmospheric warming (OEH 2015a). Notwithstanding, the contribution and impact from the Project is considered to be insignificant.

“Degradation of native riparian vegetation along NSW watercourses”

Vegetation adjacent to riparian environments is proposed for removal and as such the Project may incrementally contribute to the KTP ‘Degradation of native riparian vegetation along NSW watercourses’. It is considered that the Project is unlikely to result in a large impact in accordance with this KTP, however, it is prudent to consider impact minimisation and mitigation where possible to limit the effects of this KTP.

Conversely, the Project aims to reduce the amount of mine water discharge into the Coxes River. It is anticipated that this action would result in improved water quality downstream of the site, thus aid in the improvement of stream health.

“Invasion of native plant communities by exotic perennial grasses”

The Project is unlikely to directly contribute to the KTP “Invasion of native plant communities by exotic perennial grasses” due to the retention of a majority of the native grass layer and only a small area of surface vegetation to be removed for the Project. However, some disturbed areas within the impact area already contain exotic perennial grasses. The Project will provide an opportunity to enact a weed control program to ameliorate this KTP.

5.0 Development Impact Thresholds

There are matters listed in Section 9.2 of the FBA which will be directly impacted upon and therefore, require further consideration by the consent authority. These are discussed in the following sections.

5.1 Impacts on Landscape Features

The Study Area contains a 'State Significant Biodiversity Link' which is a riparian buffer of a 6th order stream, specifically, the Cox's River. Additional information is required to assess the loss of native vegetation within a 50 m buffer within either side of a 6th order stream. The following provides additional information with regards to the matters listed in section 9.2.3.3 of the FBA.

- a) The Cox's River is a 6th order stream where the Study Area intersects it.
- b) The total area of the riparian buffer which may potentially be impacted upon Study Area is approximately 0.02 ha. This area (0.02 ha) is made of an area of approximately 20 metres x 10 metres.
- c) This area (0.02 ha) comprises a disturbed variant of HN602 Tableland swamp meadow on impeded drainage sites of the western Sydney Basin and South Eastern Highlands.
- d) There is potential for indirect impacts upon the water course as a result of sediment and erosion.
- e) This area which exists in a disturbed state is proposed to be temporarily impacted upon by trenching followed by rehabilitation. Consequently, the net loss of this riparian buffer is proposed to be negligible following rehabilitation. Indirect impacts from erosion and sedimentation are not anticipated provided that the minimisation measures in **Section 4.3** are adhered to.

5.2 Impacts on Native Vegetation

The Study Area contains a disturbed variant of vegetation described as HN602 (Tableland swamp meadow on impeded drainage sites of the western Sydney Basin and South Eastern Highlands), which is considered to be commensurate with *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions* EEC. This EEC is specifically mentioned in the Secretary's Environmental Assessment Requirements (SEARs) as requiring detailed consideration. The following provides additional information in response to matters listed in Section 9.2.4.2 of the FBA.

- a) Approximately 0.02 ha of the above mentioned EEC may potentially be impacted upon within Study Area. This area (0.02 ha) is made of an area of approximately 20 metres x 10 metres of disturbed and degraded condition vegetation.
- b) The linear development module was used to calculate this Project, consequently, the 550 metre buffers were applied and this EEC was not identified within it.
- c) An estimate of the extent within the region has been gained from the vegetation of the Western Blue Mountains (DEC 2006). Approximately 97.6 ha of the MU 53 commensurate with HN602 has been mapped within the region. Approximately 84.5 % of this HN602 is classified as being highly disturbed within the region.
- d) (i) The small and temporary impacts are not anticipated to have any long term impacts to the abiotic factors critical to the survival of the EEC.

(ii) Characteristic and functional species may be temporarily impacted and these species should be replaced during rehabilitation of the area.

(iii) As a result of the ground disturbance, there is potential for indirect impacts such as; assisting the introduction of weeds and/or pathogens (e.g. *Phytophthora* and *Chytrid* fungus). These potential indirect impacts should be minimised by stringent weed control and wash down procedures as outlined in **Section 4.3**.

- e) There is unlikely to be any fragmentation of the EEC following the planned rehabilitation.
- f) Proposed mitigation including active rehabilitation and weed control program following Project construction would not diminish the recovery of the EEC in the IBRA subregion.

5.3 Impacts on Threatened Species

The Study Area contains an endangered flora species (*Caesia parviflora* var. *minor*) which is specifically nominated in the SEARs as requiring additional consideration. In addition, a critically endangered species avifauna species (Regent Honeyeater) has been assessed as likely to occur within the Project area. The following provides additional information with regards to the matters listed in Section 9.2.5.2 of the FBA.

Regent Honeyeater

- a) The Regent Honeyeater has been well-documented from the Capertee and Glen Alice area, located within approximately 38 km north of the Study Area. One individual was recently observed on the Coxs River at Little Hartley; approximately 20 km from the Study Area (October 2015). One record exists within the Wolgan State Forest, and another record near Ben Bullen, approximately 17 km north-east of the Study Area.
- b) (i) Habitat for the Regent Honeyeater occurs within the region, with areas of high importance located within Capertee Valley to the north. This species is periodically observed within the locality with the most recent Regent Honeyeater observation in October 2015 along the Coxs River at Little Hartley. Habitat critical to the survival of these species within the locality is generally associated with various Box species, particularly White Box (*Eucalyptus albens*) and Yellow Box (*Eucalyptus melliodora*). Neither of these species were observed within the Study Areas. In addition, there were few mistletoe occurrences; another indicator of habitat suitability. While the Study Area is located nearby important Regent Honeyeater habitat areas (i.e. Capertee Valley), it is considered that the absence of important habitat values such as Box species substantially limits the Study Area's value for the Regent Honeyeater.
 - (ii) The Project is unlikely to reduce the area of occupancy of this highly mobile species (i.e. remove, alter or fragment a habitat patch of importance to the species).
 - (ii) The breeding cycle of a population of the Regent Honeyeater, if present, is unlikely to be disrupted by the Project as there is no evidence of breeding or suitable breeding habitat within the Study Area.
- c) *Eucalyptus albens* (White Box), *Eucalyptus melliodora* (Yellow Box), *Eucalyptus leucoxylon* (Yellow Gum) and *Eucalyptus sideroxylon* (Mugga Ironbark) growing in high quality sites, where nectar production is copious and relatively predictable, appear to be critical to the survival of the Regent Honeyeater (Menkhurst et. al. 1999). None of these tree species have been recorded within the Study Area. Therefore, no critical habitat will be affected. The small loss of potential foraging habitat from clearing would not constitute a decrease in the availability or quality of habitat to the extent that the species is likely to decline.
- d) The habitat to be removed will not force fragmentation upon a population of this species, if it occurred within the Study Areas.

- e) The Regent Honeyeater has been well-documented from the Capertee and Glen Alice area, located within approximately 38 km north of the Study Area. One record exists within the Wolgan State Forest, and another record near Ben Bullen, approximately 17 km north-east of the Study Area. Due to the widespread distribution of winter-flowering Eucalypt species within the region, the potential habitats in the Study Areas would not be of high importance to this species.
- f) The Project is unlikely to contribute to an increase in invasive species that may be harmful to this species.
- g) Proposed mitigation including active rehabilitation and weed control program following Project construction would not diminish the recovery of the species in the IBRA subregion.

Caesia parviflora* var. *minor

- a) The endangered herb *C. parviflora* var. *minor* was identified in both the Northern and Southern Study Areas (n=3), with two specimens observed in the eastern 'in common' section. Notwithstanding, *C. parviflora* var. *minor* is a cryptic species that cannot be detected outside of its flowering period (spring-summer) and the surveys within the Southern Study Area were conducted outside of this period. The individuals of *C. parviflora* var. *minor* observed within the Southern Study Area, although these records were within the 'in common' part of the Northern and Southern Study Areas. Given this, a precautionary approach has been adopted whereby three individuals have been assumed present within the Southern Study Area. It is recommended that pre-clearance surveys are conducted within the Southern Study Area during the flowering period to confirm this assumption and where possible provide mitigation measures.

For the purposes, of this assessment the local population has been defined as occurring within approximately 6 km of the Study Area. RPS have recently recorded approximately 181 individuals in unpublished findings in addition to a single location obtained from the Bionet Atlas database (i.e. one location with 24 individuals). This gives a combined local population estimate of 206 individuals. However, due to the cryptic nature of this species and the difficulty involved in positive identification (refer to section (b) below), the local population is considered to be much larger than the individuals which have been previously recorded within proximity of the site. Given the above records, it is estimated that the loss of *C. parviflora* var. *minor* would be less than 1.5% of the local population.

- b) Habitat for the *Caesia parviflora* var. *minor* is described as damp places in open forest on sandstone. This variety may be more common than currently known, as Pale Grass-lilies are often not identified to variety level (OEH 2016). Two other larger varieties of *C. parviflora* have been described and are more common and widespread. A small or stunted *C. parviflora* of another variety may potentially be mistaken for *C. parviflora* var. *minor*. RPS surveys identified *Caesia parviflora* var. *minor* and individuals of *Caesia parviflora* var. *parviflora*. These identifications were also confirmed by the Royal Botanic Gardens and Domain Trust.

The majority of the Project is located within areas where *C. parviflora* var. *minor* has not been recorded and the sandstone habitats in which it is known to occur only occur in the eastern end of the Study Areas on the Newnes Plateau. Where the suitable habitats does exist this linear development is only temporarily clearing the side of existing tracks, pipelines and powerline easements which will regrow following the initial disturbance. Therefore, the Project is unlikely to permanently decrease the available habitat for the species.

- c) The ecology and biology of the residual plant population is not considered to be at a disadvantage as a result of the Project.

- d) Where the suitable habitats does exist for *C. parviflora* var. *minor*, the proposed linear development is only temporarily clearing the side of existing tracks, pipelines and powerline easements which will regrow following the initial disturbance. Consequently, the development is not likely to isolate or fragment any local populations of *C. parviflora* var. *minor*.
- e) Due to the limited information available with regards to *C. parviflora* var. *minor* (OEH 2016). It is currently very difficult to comment on the relationship of the local population to other populations of the species.
- f) The Project is unlikely to contribute to an increase in invasive species that may be harmful to this species.
- g) Proposed mitigation including active rehabilitation and weed control program following Project construction would not diminish the recovery of the species in the IBRA subregion.

5.4 Impacts for which the Assessor is Required to Determine an Offset

The Project involves the removal of PCTs (with a site value score of >17) associated with threatened species habitat. Therefore, a biodiversity offset requirement is to be calculated via application of the FBA BioBank Calculator.

5.5 Impacts for which the Assessor is Not Required to Determine an Offset

All relevant considerations have been captured by above categories.

5.6 Impacts that Do Not Require Further Assessment by the Assessor

All relevant considerations have been captured by above categories.

6.0 Offset Requirements

6.1 Credit Report

The Development BioBank Credit Report generated by the BioBanking Credit Calculator is provided in **Appendix 2**. A summary of the ecosystem credits required is provided in **Table 17** and a summary of the species credits required is provided in **Table 18**.

Table 17 Summary of Ecosystem Credits Required

Vegetation Community	Northern Area (ha)	Northern Credits	Southern Area (ha)	Southern Credits
HN508 Blue Mountains Mallee Ash - Dwarf Casuarina heath of the upper Blue Mountains, Sydney Basin	0.00	0	0.17	6
HN514 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands	0.47	22	0.47	22
HN558 Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands	1.11	58	1.24	70
HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highland (Poor Condition)	21.22	779	21.45	793
HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highland	1.49	79	1.26	67
HN572 Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands	0.63	24	0.61	21
HN599 Sydney Peppermint - Narrow-leaved Peppermint shrubby open forest on sheltered slopes of the Newnes Plateau, Sydney Basin	0.73	35	0.19	9
HN600 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin	1.71	91	5.57	248
HN602 Tableland swamp meadow on impeded drainage sites of the western Sydney Basin and South Eastern Highlands	0.02	1	0.02	1
HN630 <i>Phragmites australis</i> and <i>Typha orientalis</i> coastal freshwater wetlands	0.46	8	0.46	8
Total	27.84	1097	31.44	1245

In interpreting the credit quantum's outlined in Table 17 it should be noted that a maximum impact liability has been calculated for the area where the water treatment plant is to be constructed. It is noted that the impact extent for HN570 (in poor condition) within that area is estimated to be 19.44 ha and that there is potential for the Project to reduce the loss of HN570 through careful placement and design. These impact avoidance outcomes are not yet known and can only be calculated once further design details are available for analysis.

Table 18 Summary of Species Credits Required

Species	Northern Study Area	Northern Species Credits	Southern Study Area	Southern Species Credits
<i>Eucalyptus cannonii</i> (Capertee Stringybark)	3	39	3	39
<i>Caesia parviflora</i> var. <i>minor</i> (Pale Grass-lily)	3	42	3	42
Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	0.73 ha	9	0.36 ha	5
Total	-	90	-	86

The Southern Study Area would result in approximately 3.60 ha of additional clearing when compared to the Northern Study Area. Consequently, the ecosystem credit requirements for the Southern Study Area are 157 credits higher than that of the Northern Study Area. Conversely, the Northern Study Area requires a slightly higher number of Species credits to be retired as a result of the larger area of potential habitat for the Large-eared Pied Bat which is proposed to be impacted upon. Based upon these findings, the Northern Study Area will result in less biodiversity impacts when compared to the Southern Study Area.

6.2 Project Application Area

This report provides survey results and impact assessments for both the Northern and Southern Study areas. A comparison of potential impacts for the two study areas is included in **Section 4.0**. The comparison concluded the Southern Study Area would likely have a greater impact on biodiversity. The vegetation clearing within the Northern Study Area is less than the vegetation clearing (31.44 ha) required for the Southern Study Area.

The Northern Study Area, as shown in **Figure 1**, has been selected as the preferred route and is hereafter referred to as the Project Application Area as shown in **Figure 6**. Consequently, the Southern Study Area is not discussed any further in this report.

The Project Application Area corresponds to the area surveyed and assessed within the Northern Study Area described in **Section 1.2**, and includes the northern pipeline route on Newnes Plateau. This option has been selected based on the ecological assessment (this report) in conjunction with geomorphological assessments undertaken for the two study areas. Vegetation clearing within the Project Application Area will be 27.84 ha and corresponds to the disturbance footprint noted in **Section 1.3** for the Northern Study Area. It is this quantum of vegetation clearing that has been used in the Projects' biodiversity offset calculations in accordance with FBA (OEH, 2014) and reported in **Section 7.0**.

Stage 3 – Biodiversity Offset Package

7.0 Biodiversity Offset Package

7.1 Overview

The Project fits within the Western Region Biodiversity Offset Package (WRBOP) (Centennial Coal 2016 *in prep.*) and has been relied on in the compilation of the BOP for this Project. The WRBOP comprises a number of Centennial owned/ controlled sites identified in the Strategic Lands Assessment (Centennial 2012) as suitable for biodiversity offsetting purposes. The WRBOP includes offset lands, land management initiatives and rehabilitation as part of a holistic approach to conservation and enhancement of biodiversity values within the greater Lithgow area (Centennial Coal 2016 *in prep.*). The following sections outline how the WRBOP (Centennial Coal 2016 *in prep.*) was used to address the offsetting requirements for this Project. These sites are listed below in **Table 19**.

Table 19 Summary of Potential Biodiversity Offset Site

Description	Site	Lot and DP
Direct Offset	Airly	Lot 59 DP755757 Lot 135 DP755757 Lot 163 DP48336
	Wolgan Road North	Lot 56 DP751636 Lot 100 DP1033592
	Commonwealth Colliery	Lot 1 DP65810 Lot 1 DP52856
Land Management	Wolgan Road South	Lot 1 DP597541, Lot 25 DP827626 and Lot 27 DP827626
	Brays Lane	Lot 164 DP751651 Lot 4 DP1088207 Two lots - Lot 101 DP 1137972
	Coxs River	Lot 1 DP751636 Lot 15 DP751636 Lot 2 DP751636 Lot 24 DP751636 Lot 28 DP751636 Lot 4 DP751636 Lot 6 DP751636 Lot 23 DP827626 Lot 26 DP827626 Lot 358 DP44086

The WRBOP was initially prepared for the Springvale Mine Extension Project EIS (SSD 5594) (RPS 2014) and is presently being updated to address the offsetting needs for this Project (Centennial Coal 2016 *in prep.*). The following sections outline how the WRBOP (Centennial Coal 2016 *in prep.*) would be used to address the offsetting requirements for this Project.

7.2 Preliminary Assessment of Ecological Values to be Addressed

The Project will result in the loss of approximately 27.84 ha within the preferred route (Northern Study Area), as outlined in **Section 6.1**. The Biodiversity Offset Package designed to address these impacts is provided in the WRBOP (Centennial Coal 2016 *in prep.*). A summary of how this package would address the Project impacts is outlined in the following sections.

7.3 Suitability

The biodiversity offsets would be land based and are within an area owned/ controlled by Centennial Coal. A combination of direct and land management offsets are proposed. The suitability of these offsets for the Project have been assessed using 'ecosystem' and 'species' credits, as outlined in the following sections.

7.3.1 Ecosystem Credits

A credit profile for an ecosystem credit defines two attributes that collectively represent the key criterion for offsetting rules, these being:

- IBRA subregion
- PCT.

Potential offset sites considered in this analysis are listed in the WRBOP. The following sections discuss offset site suitability against the PCT and IBRA subregion eligibility criteria.

7.3.1.1 IBRA Subregions

According to the FBA, ecosystem credits can only be sourced from the IBRA subregion that the development occurs within, any adjoining IBRA subregion of the same IBRA region or any other adjoining IBRA subregion. As the Project crosses two IBRA subregions, this means that the offset site(s) for ecosystem credits must be located within those regions or adjacent regions, these being:

- Capertee (Sydney Basin Bioregion) – Project impact.
- Wollemi (Sydney Basin Bioregion) – Project impact.
- Burragoorang (Sydney Basin Bioregion) – Adjacent subregion.
- Hill End (South Eastern Highlands Bioregion) – Adjacent subregion.

The suitability of potential offset sites described in the WRBOP (Centennial Coal 2016 *in prep*), with regards to the IBRA subregion criteria, is outlined in **Table 20**.

Table 20 Potential Offset Site Suitability: IBRA subregions

Potential Offset Site (WRBOP)	IBRA subregion	Suitable?
Direct		
Airly	Capertee (Part B)	Yes
Wolgan Road North	Capertee (Part B)	Yes
Lamberts Gully	Capertee (Part B)	Yes
Commonwealth Colliery	Capertee (Part B)	Yes
Land Management		
Wolgan Road South	Capertee (Part B)	Yes
Brays Lane	Capertee (Part B)	Yes
Coxs River	Capertee (Part B)	Yes

7.3.1.2 PCTs

The BioBanking Credit reports provided in **Appendix 2** outline the 'like for like' PCT offset options available for each of the PCTs impacted by the Project. **Table 21** lists the PCTs impacted by the Project and corresponding PCT offset options.

Table 21 Potential Offset Site Suitability: IBRA Subregions

PCT (Impact)	PCT Offset Options
Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands Bioregion, (HN558)	Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands Bioregion, (HN558) Blaxland's Stringybark - Blue Mountains Ash - Blackwood moist open forest on basalt caps of the Blue Mountains, Sydney Basin Bioregion, (HN507) Brown Barrel - Mountain Grey Gum tall moist forest on basalts of the Southern Highlands Bioregion and Sydney Basin Bioregion, (HN516) Sydney Peppermint - White Stringybark moist shrubby forest on elevated ridges, Sydney Basin Bioregion, (HN601)
Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion, (HN514)	Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion, (HN514) Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion, (HN614) Ribbon Gum - Yellow Box grassy woodland on undulating terrain of the eastern tablelands, South Eastern Highlands Bioregion, (HN573)
Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion, (HN572)	Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion, (HN572)
Sydney Peppermint - Narrow-leaved Peppermint shrubby open forest on sheltered slopes of the Newnes Plateau, Sydney Basin Bioregion, (HN599)	Sydney Peppermint - Narrow-leaved Peppermint shrubby open forest on sheltered slopes of the Newnes Plateau, Sydney Basin Bioregion, (HN599) Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion, (HN600)
Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion, (HN600)	Sydney Peppermint - Narrow-leaved Peppermint shrubby open forest on sheltered slopes of the Newnes Plateau, Sydney Basin Bioregion, (HN599) Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin Bioregion, (HN600)
Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (HN570)	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (HN570) Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion, (HN543)
Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion, (HN602)	Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion, (HN602)

PCTs included in the WRBOP are listed in **Table 22**. A suitability analysis on the basis of 'like for like' PCTs, as impacted by the Project, is also provided.

Table 22 Potential Offset Site Suitability: 'Like for Like' PCTs

Potential Offset Site	Western Blue Mountains Vegetation Community (DEC 2006)	PCT	Suitable
Direct			
Airly	MU13 Tableland Gully Ribbon Gum - Blackwood - Apple Box Forest	HN501	No
	MU20 Capertee Rough-barked Apple - Redgum - Yellow Box Grassy Woodlands	HN614	Yes (HN514)
	MU20 Capertee Rough-barked Apple - Redgum - Yellow Box Grassy Woodlands (Derived grasslands)	HN614	Yes (HN514)
	MU21 Capertee - Wolgan Slopes Red Box - Grey Gum - Stringybark Grassy Open Forest	HN534	No
	MU38 Capertee Grey Gum - Narrow-leaved Stringybark - Scribbly Gum - Callitris - Ironbark Shrubby Open Forest	HN534	No
	MU38 Capertee Grey Gum - Narrow-leaved Stringybark - Scribbly Gum - Callitris - Ironbark Shrubby Open Forest (Derived grasslands)	HN534	No
	MU42 Capertee Hills White Box - Tumbledown Redgum - Ironbark - Callitris Shrubby Woodland	HN544	No
	MU54 Capertee - Wolgan Riparian Rough-barked Apple - River Oak Open Forest	HN574	No
Wolgan Road North	MU8 Newnes Sheltered Peppermint - Brown Barrel Shrubby Forest	HN599	Yes (HN599)
	MU11 Tableland Gully Snow Gum - Ribbon Gum Montane Grassy Forest	HN572	Yes (HN572)
	MU11 Tableland Gully Snow Gum - Ribbon Gum Montane Grassy Forest (derived grasslands)	HN572	Yes (HN572)
	MU15 Tableland Hollows Black Gum - Black Sally Open Forest	HN504	No
	MU15 Tableland Hollows Black Gum - Black Sally Open Forest (derived grasslands)	HN504	No
	MU28 Sandstone Plateau And Ridge Scribbly Gum - Silver-top Ash Shrubby Woodland	HN600	Yes (HN600)
	MU29 Sandstone Slopes Sydney Peppermint Shrubby Forest	HN600	Yes (HN600)
	MU30 Exposed Blue Mountains Sydney Peppermint - Silver-top Ash Shrubby Woodland	HN600	Yes (HN600)
	MU35 Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest	HN590	No
	MU37 Cocks Permian Red Stringybark - Brittle Gum Woodland	HN570	Yes (HN570)
	MU37 Cocks Permian Red Stringybark - Brittle Gum Woodland (derived grasslands)	HN570	Yes (HN570)
	MU43 Pagoda Rock Sparse Shrubland	HN544	No
Lamberts Gully	MU11 Tableland Gully Snow Gum - Ribbon Gum Montane Grassy Forest	HN572	Yes (HN572)
	MU15 Tableland Hollows Black Gum - Black Sally Open Forest	HN504	No
Commonwealth Colliery	MU11 Tableland Gully Snow Gum - Ribbon Gum Montane Grassy Forest	HN572	Yes (HN572)
	MU15 Tableland Hollows Black Gum - Black Sally Open Forest	HN504	No
	MU33 Tableland Broad-leaved Peppermint - Brittle Gum - Red Stringybark Grassy Open Forest	HN514	Yes

Potential Offset Site	Western Blue Mountains Vegetation Community (DEC 2006)	PCT	Suitable
Land Management			
Wolgan Road South	MU11 Tableland Gully Snow Gum - Ribbon Gum Montane Grassy Forest	HN572	Yes (HN572)
	MU15 Tableland Hollows Black Gum - Black Sally Open Forest	HN504	No
	MU37 Cocks Permian Red Stringybark - Brittle Gum Woodland	HN570	Yes (HN570)
Brays Lane	MU15 Tableland Hollows Black Gum - Black Sally Open Forest (derived grassland)	HN504	No
Cocks River	MU15 Tableland Hollows Black Gum - Black Sally Open Forest	HN504	No
	MU15 Tableland Hollows Black Gum - Black Sally Open Forest (derived grassland)	HN504	No

7.3.1.3 WRBOP Adequacy

The BioBanking Credit reports provided in **Appendix 2** outline the 'like for like' PCT offset options available for each of the PCTs impacted by the Project. **Table 23** listed the PCTs impacted by the Project and corresponding PCT offset options. Negative balances are presented in (brackets).

Table 23 Net Balance: PCT 'Like for Like' Ecosystem Credits

Vegetation Community	Available Credits WRBOP	Northern Study Area	
		Required Credits	WRBOP Net Balance
HN514 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands	1,165	22	1,143
HN558 Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands	(953)	58	(1,011)
HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highland	(84)	858	(942)
HN572 Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands	237	24	216
HN599 Sydney Peppermint - Narrow-leaved Peppermint shrubby open forest on sheltered slopes of the Newnes Plateau, Sydney Basin	(34)	35	(69)
HN600 Sydney Peppermint - Silvertop Ash heathy open forest on sandstone ridges of the upper Blue Mountains, Sydney Basin	(2,137)	91	(2,228)
HN602 Tableland swamp meadow on impeded drainage sites of the western Sydney Basin and South Eastern Highlands	10	1	9
HN630 <i>Phragmites australis</i> and <i>Typha orientalis</i> coastal freshwater wetlands	0	8	(8)
Total	-1,796	1,097	-2,890

Considerable opportunity exists to reduce the impact on HN570 within the area where the water treatment plant is to be constructed. The ecosystem credit to area ratio is 36.96 ecosystem credits per hectare, with the maximum potential impact reduction possible for this part of the Study Area being 19.44 ha. Detailed design is required to substantiate any impact avoidance outcomes gained for this part of the Project.

A comparison between the Projects' offsetting requirements and WRBOP ecosystem credit availability at a vegetation formation level (i.e. variation rule Section 10.5.4.1 of the FBA) is provided in **Table 24** to investigate the alternative trading arrangements available under the FBA. Negative balances are presented in (brackets).

Table 24 Net Balance: Formation 'Like for Like' Ecosystem Credit

Formation	WRBOP	Northern Study Area	
		Required Credits	WRBOP Net Balance
Grassy Woodlands	3,518	22	3,496
Dry Sclerophyll Forests (Shrubby subformation)	2,267	984	1,283
Wet Sclerophyll Forests (Shrubby subformation)	(953)	58	(1,011)
Freshwater Wetlands	10	9	1
Total	4,852	1,082	3,770

Using FBA variation rule Section 10.5.4.2(a), the WRBOP would satisfy the ecosystem credit demand for all PCTs impacted by the Project with the exception of HN558 Narrow-leaved Peppermint - Mountain Gum - Brown Barrel moist open forest on high altitude ranges, northern South Eastern Highlands Bioregion (i.e. offsetting at a vegetation formation level). As HN558 is not listed as a threatened ecological community under the EPBC Act, it is possible to consider the application of FBA variation rule Section 10.5.4.2(b) to address this shortfall. Pending consideration of this offsetting approach by the OEH, it is considered that the Project can satisfy its biodiversity offsetting requirements in a manner compliant with the FBA.

7.3.2 Species Credits

Threatened species included in the WRBOP are listed in **Table 25**. A 'like for like' suitability analysis of the WRBOP relative to the Project impacts is also provided.

Table 25 Potential Offset Site Suitability: 'Like for Like' Threatened Species

Species	WRBOP	Northern Study Area	
		Required Credits	WRBOP Net Balance
<i>Eucalyptus cannonii</i> (Capertee Stringybark)	36	39	(3)
<i>Caesia parviflora</i> var. <i>minor</i> (Pale Grass-lily)	0	42	(42)
Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	(1,015)	9	(1,024)
Total		90	

Table 25 identifies the WRBOP to be deficient in the provision of 'like for like' species credits for all three species. Section 10.5.7.1 of the FBA allows for a variation to species credit trading as specified in Section 10.5.6 (i.e. like for like species credits). A comparison between the Projects offsetting requirements and WRBOP species credit availability at a life-form (flora) or 'order' (fauna) level, as permitted under Section 10.5.7.3 of the FBA, is provided in **Table 26** to investigate the alternative trading arrangements available under the FBA.

Table 26 Potential Offset Site Suitability: 'Like for Like' Threatened Species

Impact Species	WRBOP Alternative species ⁵	WRBOP	Project Application Area (Northern Study Area)	
			Required Credits	WRBOP Net Balance
<i>Eucalyptus cannonii</i> (Capertee Stringybark)	<i>Eucalyptus aggregata</i> (Black Gum)	2,436	39	2,397
<i>Caesia parviflora</i> var. <i>minor</i> (Pale Grass-lily)	No Schedule 1 or 1A species available as alternative	0	42 ⁶	(42)
Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	(1,015)	9	(1,024)
Total		4,322	90	1,331

The WRBOP would satisfy, at a life-form or 'order' level, the Projects' species credit demand for one of the three species impacted (i.e. use of variation rule specified under Section 10.5.7.3(b) of the FBA). Variation rules cannot be applied to the Large-eared Pied Bat (*Chalinolobus dwyeri*), as this species is listed on the EPBC Act (exclusion identified under Section 10.5.7.2(b)). The WRBOP would be in deficit for this species.

However, alternative offsetting arrangements exist for *Caesia parviflora* var. *minor* (Pale Grass-lily) despite the unavailability of a 'like for like' or suitable variation option under Section 10.5.7.3(b) of the FBA. Additional species credit trading options would need to be incorporated into the WRBOP to satisfy a variation under Section 10.5.7.3(b) (i.e. find an offset site containing an endangered or critically endangered flora species listed under the TSC Act) or consider options for supplementary measures for species credits under Section 10.5.7.5. The most suitable offsetting approach would be determined following the consideration of impact avoidance options available at the detailed design and/ or construction stage (i.e. use of pre-clearance surveys to achieve impact avoidance outcomes).

7.4 Assessment of the Biodiversity Offset Package Against Principles for Biodiversity Offsetting

The following provides an assessment of the proposed biodiversity offsets against these principles.

7.4.1 Impact Avoidance and Mitigation

Global design initiatives used in the Project for avoiding disturbances on biodiversity values are listed below:

- Alignment of the pipeline, where possible, with existing disturbances (e.g. cleared lands, existing pipelines) to reduce the need for vegetation clearing; and
- Placement of the water treatment plant within a previously disturbed area.

⁵ Plant species identified as being potentially suitable for offsetting under FBA variation rule Section 10.5.7.3(b)

⁶ Assumed impact. Liability may be reduced following implementation of impact avoidance during detailed design/ construction stages (i.e. pre-clearance surveys).

Notwithstanding these design imperatives, two separate pipeline routes were considered. At a native vegetation scale it was found that the Northern Study Area would have a lesser impact on biodiversity values (i.e. 3.60 ha).

Further opportunity still exists to reduce the Project impacts, specifically in the area where the water treatment plant would be established (i.e. the impact footprint for the water treatment plant is approximately half the area assessed). Through careful design, it is considered that the calculated ecosystem credit liability for HN570 may be reduced by a maximum of 719 ecosystem credits should an impact outcome of 19.44 ha be achieved within this part of the Study Area.

Other key impact management actions include various mitigation strategies as outlined in **Sections 4.3**.

7.4.2 Basis for Assessing Biodiversity Losses and Gains

The BOP has been developed to target the PCTs and threatened species impacted by the Project. Where there is a shortfall in ecosystem credits for PCTs impacted by the Project, additional offsets have been provided in the WRBOP at the vegetation formation level. Further opportunity to provide additional ecosystem credits through the WRBOP exists utilising high conservation value PCTs such as NH504 (MU15 Tableland Hollows Black Gum - Black Sally Open Forest) and HN614 (MU20 Capertee Rough-barked Apple - Redgum - Yellow Box Grassy Woodlands), which are both listed as TECs.

7.4.3 Offsets must be Targeted to the Biodiversity Values Being Lost

The Project impacts can be largely satisfied by the WRBOP at a vegetation formation level as allowed for under Section 10.5.4.1 of the FBA. The shortfall in suitable vegetation formation level offsets for impacts on HN558 would be addressed through the current revision process being performed for the WRBOP (Centennial 2016 *in prep.*).

7.4.4 Offsets must be Additional to Other Legal Requirements

The offset lands provided for in the WRBOP satisfy the 'additionality' rule outlined in the FBA.

7.4.5 Offsets must be Enduring, Enforceable and Auditable

The WRBOP outlines the conservation mechanisms used to deliver biodiversity offsets. They are designed to be enduring, enforceable and auditable.

7.4.6 Supplementary Measures can be Used in Lieu of Offsets

No supplementary measures are proposed as it is intended to deliver the biodiversity offsets through the WRBOP.

7.4.7 Offsets can be Discounted Where Significant Social and Economic Benefits Accrue to NSW

No proposal to request a discounted biodiversity offset requirement is included in this BOP.

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