APPENDIX B. FLORISTIC AND VEGETATION INTEGRITY PLOT SURVEY FIELD RECORDS

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BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	15/06/18	TVH	Veg Zone 1	Damian Licari and Gina Minatel			
Zone 56	Datum GDA 1994	Plot ID	19	Plot dimensions	20m X 50m	Photo #	
Easting 555890	Northing 6873927	IBRA region	Burringbar-Conondale Ranges	Midline bearing from 0 m	350 Magnetic °		
Vegetation Class		Coastal Swamp Forest				Confidence: H M L	
Plant Community Type		1064		EEC: Yes		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of **Native Richness**	Trees	4
	Shrubs	1
	Grasses etc.	2
	Forbs	5
	Ferns	3
	Other	1
Sum of **Cover** of native vascular plants by growth form group	Trees	30.3
	Shrubs	0.2
	Grasses etc.	10.5
	Forbs	30.3
	Ferns	50.4
	Other	15
High Threat Weed cover		10

BAM Attribute (1000 m² plot)		
DBH	**# Tree Stems Count**	**# Stems with Hollows**
80 + cm	0	0
50 – 79 cm	0	
30 – 49 cm	Present	
20 – 29 cm	present	
10 – 19 cm	present	
5 – 9 cm	absent	
< 5 cm	present	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	253.50 Tally space	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	100	100	100	100	100	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	100																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 15 / 06 / 18	TVH	19	Damian Licari and Gina Minatel

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
Tree	Melaleuca quinquenervia-Broad-leaved Paperbark	N	30		U	
Tree	Macaranga tanarius-Blush Macaranga	N	0.1	1	G	
Other	Parsonsia straminea-Common Silkpod	N	15		U	
Exotic	Paspalum conjugatum-Sour Grass	E	40		G	
Shurb	Hibiscus diversifolius-Swamp Hibiscus	N	0.2	2	M	
HTE	Ipomoea cairica- Coastal Morning Glory	HTE	10		G,M	
Fern	Blechnum indicum-Swamp Water Fern	N	50		G	
Forb	Persicaria strigosa- Spotted Knotweed	N	20		G	
Grass	Phragmites australis-Common Reed	N	10		G	
Forb	Solanum americanum-Glossy Nightshade	N	0.1	2	G	
Forb	Crinum pedunculatum-Swamp Lily	N	0.1	3	G,M	
Tree	Glochidion ferdinandi-Cheese Tree	N	0.1	1	G	
Forb	Persicaria dichotoma-Blume	N	0.1	3	G	
Grass	Baumea rubiginosa- Soft twigrush	N	0.5	30	G	
Forb	Persicaria sp.-Persicaria	N	10		G	
Fern	Hypolepis muelleri-Harsh Ground Fern	N	0.1	2	G	
Fern	Lygodium microphyllum-Climbing Snake Fern	N	0.3	2	M	
Tree	Melicope elleryana-Pink-flowered Doughwood	N	0.1	1	M	
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	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

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BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	10 / 07 / 18	TVH	Veg Zone 1	Damian Licari and Gina Minatel			
Zone 56	Datum GDA1994	**Plot ID**	16	**Plot dimensions**	20m X 50m	**Photo #**	
Easting 555 898	Northing 68 73830	**IBRA region**	Burringbar-Conondale Ranges	**Midline bearing from 0 m**	310 Magnetic °		
Vegetation Class		Coastal Swamp Forests				Confidence: H M L	
Plant Community Type		1064		**EEC:** Yes		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of **Native Richness**	**Trees**	5
	Shrubs	2
	Grasses etc.	5
	Forbs	1
	Ferns	2
	Other	2
Sum of **Cover** of native vascular plants by growth form group	**Trees**	26.8
	Shrubs	0.7
	Grasses etc.	40
	Forbs	10
	Ferns	120
	Other	25
High Threat Weed cover		13.5

BAM Attribute (1000 m² plot)		
DBH	**# Tree Stems Count**	**# Stems with Hollows**
80 + cm	0	1
50 – 79 cm	0	
30 – 49 cm	present	
20 – 29 cm	present	
10 – 19 cm	present	
5 – 9 cm	present	
< 5 cm	present	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	252 Tally space	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	95	70	80	95	100	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	88																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	10 / 07 / 18	TVH	16	Damian Licari and Gina Minatel

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
Tree	Melaleuca quinquenervia-Broad-leaved Paperbark	N	20		U	
Other	Archontophoenix cunninghamiana-Bangalow Palm	N	10		M	
Tree	Melicope elleryana-Pink-flowered Doughwood	N	5	4	M	
Fern	Blechnum indicum-Swamp Water Fern	N	90		G	
Grass	Phragmites australis-Common Reed	N	10		G	
Forb	Persicaria strigosa-Spotted Knotweed	N	10		G	
Other	Parsonsia straminea-Common Silkpod	N	15		U	
Grass	Lepironia articulata-Grey Rush	N	10		G	
Grass	Carex appressa-Tall Sedge	N	5	40	G	
HTE	Ipomoea cairica- Coastal Morning Glory	HTE	10		G,M	
HTE	Cinnamomum camphora-Camphor Laurel	HTE	3	20	G,M	
Shurb	Ficus coronata-Creek Sandpaper Fig	N	0.2	3	M	
HTE	Schefflera actinophylla-Umbrella Tree	HTE	0.5	1	M	
Tree	Ficus macrophylla-Moreton Bay Fig	N	1	3	M	
Tree	Ficus obliqua-Small-leaved Fig	N	0.5	1	M	
Grass	Leersia hexandra-Swamp Ricegrass	N	10		G	
Fern	Hypolepis muelleri-Harsh Ground Fern	N	30		G	
Shurb	Myrsine Howittiana-Brush Muttonwood	N	0.5	1	M	
Tree	Glochidion ferdinandi var.pubens-Cheese Tree	N	0.3	1	G	
Grass	Baumea rubiginosa-Soft twigrush	N	5	100	G	
	21					
	22					
	23					
	24					
	25					
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	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

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BAM Site – Field Survey Form

Site Sheet no: 1 of 2

Survey Name	Zone ID	Recorders
TVH	Veg Zone 2	Damian Licari and Gina Minatel

Date	Zone	Datum	Plot ID	Plot dimensions	Photo #
11/07/18	56	GDA1994	11	20m X 50m	

Easting	Northing	IBRA region	Midline bearing from 0 m
555871	6873727	Burringbar-Conondale Ranges	220 Magnetic °

		Confidence
Vegetation Class	Subtropical Rainforests	H M L
Plant Community Type	1302 — **EEC:** Yes	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of **Native Richness**	**Trees**	6
	Shrubs	0
	Grasses etc.	1
	Forbs	2
	Ferns	1
	Other	6
Sum of **Cover** of native vascular plants by growth form group	**Trees**	110.1
	Shrubs	0
	Grasses etc.	0.1
	Forbs	3
	Ferns	0.2
	Other	39.4
High Threat Weed cover		9.4

BAM Attribute (1000 m² plot)		
DBH	**# Tree Stems Count**	**# Stems with Hollows**
80 + cm	2	3
50 – 79 cm	2	
30 – 49 cm	present	
20 – 29 cm	present	
10 – 19 cm	present	
5 – 9 cm	present	
< 5 cm	present	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	119.50 Tally space	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	80	75	95	100	100	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	90																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	11/07/18	TVH	11	Damian Licari and Gina Minatel

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
Tree	Ficus macrophylla-Moreton Bay Fig	N	80		U	
Tree	Ficus obliqua-Small-leaved Fig	N	20		U	
Tree	Melaleuca quinquenervia-Broad-leaved Paperbark	N	5	1	M	
Other	Archontophoenix cunninghamiana-Bangalow Palm	N	14		G,M,U	
Other	Mucuna gigantea subsp. gigantea-Burny Bean	N	0.2	5	G,M	
Other	Maclura cochinchinensis-Cockspur Thorn	N	10		G,M,U	
HTE	Ochna serrulata-Mickey Mouse Plant	HTE	0.1	2	G	
HTE	Schefflera actinophylla-Umbrella Tree	HTE	5	10	G,M	
Other	Cordyline congesta- Narrow-leaved Palm Lily	N	0.1	2	G,M	
HTE	Ipomoea indica- Morning Glory	HTE	2	5	M,U	
Tree	Macaranga tanarius-Blush Macaranga	N	0.1	5	G	
Forb	Alpinia caerulea-Native Ginger	N	1	10	G	
HTE	Cinnamomum camphora-Camphor Laurel	HTE	0.1	2	M	
Tree	Ficus coronata-Creek Sandpaper Fig	N	2	3	M	
Exotic	Solanum chrysotrichum-Devil's Fig	E	0.1	2	G	
Other	Flagellaria indica-Whip Vine	N	15		U	
Grass	Oplismenus aemulus-Australian Basket Grass	N	0.1	5	G	
Other	Smilax australis-Lawyer Vine	N	0.1	5	M,U	
Forb	Alocasia brisbanensis-Cunjevoi	N	2	10	G	
HTE	Ligustrum sinense-Small-leaved Privet	HTE	2	5	G,M	
HTE	Lantana camara- Lantana	HTE	0.2	2	G,M	
Exotic	Solanum mauritianum-Wild Tobacco Bush	E	0.2	1	M	
Tree	Acmena smithii-Lilly Pilly	N	3	1	M	
Exotic	Murraya paniculata-Murraya	E	0.4	1	G,M	
Fern	Christella dentata- Binung	N	0.2	2	G	
Exotic	Archontophoenix alexandrae - Alexandra palm	E	56		G,M,U	
	27					
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	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

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BAM Site – Field Survey Form

Site Sheet no: 1 of 2

Date	Survey Name	Zone ID	Recorders
11/07/18	TVH	Veg Zone 4	Damian Licari and Gina Minatel

Zone	Datum	Plot ID	Plot dimensions	Photo #
56	GDA 1994	99	10m X100m	

Easting	Northing	IBRA region	Midline bearing from 0 m
555489	6873425	Burringbar-Conondale Ranges	178 Magnetic °

		Confidence: H M L
Vegetation Class	Subtropical Rainforests	
Plant Community Type	1302 — **EEC:** No	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of **Native Richness**	**Trees**	2
	Shrubs	0
	Grasses etc.	0
	Forbs	0
	Ferns	0
	Other	1
Sum of **Cover** of native vascular plants by growth form group	**Trees**	90
	Shrubs	0
	Grasses etc.	0
	Forbs	0
	Ferns	0
	Other	1
High Threat Weed cover		42

BAM Attribute (1000 m² plot)		
DBH	**# Tree Stems Count**	**# Stems with Hollows**
80 + cm	0	0
50 – 79 cm	0	
30 – 49 cm	present	
20 – 29 cm	present	
10 – 19 cm	present	
5 – 9 cm	present	
< 5 cm	present	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	34.5 Tally space	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	85	40	10	70	50	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	51																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	11/07/18	TVH	99	Damian Licari and Gina Minatel

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
Tree	Macaranga tanarius-Blush Macaranga	N	80		M,U	
HTE	Ochna serrulata-Mickey Mouse Plant	HTE	5	10	G	
HTE	Bidens pilosa-Cobblers Pegs	HTE	2	20	G	
HTE	Chloris gayana-Rhodes Grass	HTE	10		G	
HTE	Cinnamomum camphora-Camphor Laurel	HTE	10		M,U	
HTE	Schefflera actinophylla- Umbrella Tree	HTE	5	4	M,U	
Tree	Cupaniopsis anacardioides-Tuckeroo	N	10	2	M,U	
Exotic	Strelizia Sp.-Strelizia	E	0.1	1	G	
HTE	Asparagus aethiopicus-Ground Asparagus	HTE	10		G	
Other	Parsonsia straminea-Common Silkpod	N	1	1	U	
Exotic	Sonchus asper-Prickly Sowthistle	E	0.1	5	G	
	12					
	13					
	14					
	15					
	16					
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	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

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BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	12/07/18	TVH	Veg Zone 8	Damian Licari and Gina Minatel			
Zone 56	Datum GDA 1994	Plot ID	98	Plot dimensions	10m X100m	Photo #	
Easting 555619	Northing 6873327	IBRA region	Burringbar-Conondale Ranges	Midline bearing from 0 m	38 Magnetic °		
Vegetation Class		Subtropical Rainforests				Confidence: H M L	
Plant Community Type		1302		EEC: No		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of **Native Richness**	**Trees**	6
	Shrubs	0
	Grasses etc.	0
	Forbs	0
	Ferns	0
	Other	5
Sum of **Cover** of native vascular plants by growth form group	**Trees**	42
	Shrubs	0
	Grasses etc.	0
	Forbs	0
	Ferns	0
	Other	4.7
High Threat Weed cover		106

BAM Attribute (1000 m² plot)		
DBH	**# Tree Stems Count**	**# Stems with Hollows**
80 + cm	0	0
50 – 79 cm	0	
30 – 49 cm	absent	
20 – 29 cm	present	
10 – 19 cm	present	
5 – 9 cm	present	
< 5 cm	present	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0 Tally space	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	100	40	100	60	100	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	80																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	12/07/18	TVH	98	Damian Licari and Gina Minatel

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
HTE	Pinus elliottii-Slash Pine	HTE	75		U	
Tree	Guioa semiglauca-Guioa	N	3	5	M	
Tree	Mallotus philippensis-Red Kamala	N	2	3	M	
Tree	Cryptocarya triplinervis var.triplinervis-3 veined laurel	N	2	5	M	
Tree	Macaranga tanarius-Blush Macaranga	N	30		M	
HTE	Senna pendula- Senna	HTE	1	1	M	
HTE	Ipomoea cairica- Coastal Morning Glory	HTE	5	10	M,U	
Other	Smilax australis-Lawyer Vine	N	1	3	M,U	
HTE	Cinnamomum camphora-Camphor Laurel	HTE	5	5	M,U	
HTE	Ochna serrulata-Mickey Mouse Plant	HTE	2	5	M	
HTE	Schefflera actinophylla-Umbrella Tree	HTE	2	5	M,U	
Exotic	Murraya paniculata-Murraya	E	0.5	2	M	
HTE	Bidens pilosa-Cobblers Pegs	HTE	5	50	G	
Other	Maclura cochinchinensis-Cockspur Thorn	N	1	1	G,M	
HTE	Chloris gayana-Rhodes Grass	HTE	1	20	G	
Other	Parsonsia straminea-Common Silkpod	N	2	3	M,U	
Tree	Mallotus discolor-White Kamala	N	1	1	M	
HTE	Asparagus aethiopicus-Ground Asparagus	HTE	10		G	
Exotic	Syagrus romanzoffiana-Cocos Palm	E	2	1	M	
Other	Archontophoenix cunninghamiana-Bangalow Palm	N	0.5	1	G,M	
Tree	Cupaniopsis anacardioides-Tuckeroo	N	4	3	M	
Exotic	Rhaphiolepis indica-Indian Hawthorn	E	1	1	M	
Exotic	Eragrostis tenuifolia-Elastic Grass	E	10		G	
Other	Amylotheca dictyophleba-Brush Mistletoe	N	0.2	5	M	
	25					
	26					
	27					
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	31					
	32					
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	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

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BAM Site – Field Survey Form

Site Sheet no: 1 of 2

Date	Survey Name	Zone ID	Recorders
15 / 08 / 18	TVH	Veg Zone 7	Damian Licari and Christina Maloney

Zone	Datum	Plot ID	Plot dimensions	Photo #
56	GDA1994	100	10mx100m	

Easting	Northing	IBRA region	Midline bearing from 0 m
555953	6873675	Burringbar-Conondale Ranges	174 Magnetic °

		Confidence: H M L
Vegetation Class	Coastal Floodplain Wetlands	
Plant Community Type	1235 — **EEC:** No	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of **Native Richness**	**Trees**	4
	Shrubs	0
	Grasses etc.	0
	Forbs	1
	Ferns	0
	Other	1
Sum of **Cover** of native vascular plants by growth form group	**Trees**	35.8
	Shrubs	0
	Grasses etc.	0
	Forbs	0.1
	Ferns	0
	Other	3
High Threat Weed cover		33.3

BAM Attribute (1000 m² plot)		
DBH	**# Tree Stems Count**	**# Stems with Hollows**
80 + cm	0	0
50 – 79 cm	1	
30 – 49 cm	Present	
20 – 29 cm	Present	
10 – 19 cm	Present	
5 – 9 cm	Present	
< 5 cm	Present	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	9.5 Tally space	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	85	95	90	95	95	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	92																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 15 / 08 / 18	TVH	100	Damian Licari and Christina Maloney

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
Tree	1 Casuarina glauca-Swamp Oak	N	25		U	
Exotic	Melinis repens-Red Natal Grass	E	0.1	2	G	
HTE	3 Lantana camara-Lantana	HTE	2	3	M	
HTE	Bidens pilosa-Cobblers Pegs	HTE	10		G	
Tree	Macaranga tanarius-Blush Macaranga	N	0.5	10	M	
HTE	Senna pendula-Senna	HTE	2	5	M	
Exotic	Cenchrus purpureus-Barner Grass	E	35		M	
Forb	2 Oxalis sp.- Oxalis	N	0.1	1	G	
Exotic	Sonchus asper-Prickly Sowthistle	E	0.1	5	G	
HTE	Ricinus communis-Castor Oil Plant	HTE	0.2	1	M	
HTE	Ipomoea cairica-Coastal Morning Glory	HTE	6		M,U	
Exotic	Solanum mauritianum- Wild Tobacco Bush	E	5	4	M	
HTE	Schefflera actinophylla-Umbrella Tree	HTE	0.1	1	M	
Tree	Mallotus philippensis-Red Kamala	N	0.3	1	M	
Exotic	Macroptilium atropurpureum-Siratro	E	2	3	G	
Other	Diplocyclos palmatus- Native bryony	N	3	3	M	
HTE	Chloris gayana-Rhodes Grass	HTE	10		G	
HTE	Ipomoea indica-Morning Glory	HTE	3	10	M,U	
Exotic	Triumfetta rhomboidea-Chinese Bur	E	0.2	20	G	
Exotic	Passiflora subpeltata-White Passionflower	E	3	3	G,M	
Tree	Callistemon viminalis-Weeping Bottlebrush	N	10		M	
Exotic	Megathyrsus maximus var. coloratus- guinea grass	E	15		G	
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

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BAM Site – Field Survey Form

Site Sheet no: 1 of 3

		Survey Name	Zone ID	Recorders			
Date	15 / 08 / 18	TVH	Veg Zone 6	Damian Licari and Christina Maloney			
Zone 56	Datum GDA 1994	Plot ID	101	Plot dimensions	20m X 50m	Photo #	
Easting 555957	Northing 6873725	IBRA region	Burringbar-Conondale Ranges	Midline bearing from 0 m	255 Magnetic °		
Vegetation Class		North Coast Wet Sclerophyll Forests				Confidence: H M L	
Plant Community Type		1569		EEC: No		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of **Native Richness**	**Trees**	8
	Shrubs	1
	Grasses etc.	0
	Forbs	3
	Ferns	0
	Other	6
Sum of **Cover** of native vascular plants by growth form group	**Trees**	78.4
	Shrubs	2
	Grasses etc.	0
	Forbs	0.7
	Ferns	0
	Other	7.8
High Threat Weed cover		61.8

BAM Attribute (1000 m² plot)		
DBH	**# Tree Stems Count**	**# Stems with Hollows**
80 + cm	0	1
50 – 79 cm	present	
30 – 49 cm	present	
20 – 29 cm	present	
10 – 19 cm	present	
5 – 9 cm	present	
< 5 cm	present	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	15 Tally space	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	95	90	90	98	100	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	94.6																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	15 / 08 / 18	TVH	101	Damian Licari and Christina Maloney

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
Tree	Eucalyptus grandis-Flooded Gum	N	40		U	
Tree	Eucalyptus microcorys-Tallowwood	N	20		U	
Tree	Macaranga tanarius-Blush Macaranga	N	10		G,M	
HTE	Schefflera actinophylla-Umbrella Tree	HTE	15		M	
Tree	Cryptocarya triplinervis-Three-veined laurel	N	6		G,M	
HTE	Senna pendula-Senna	HTE	2	10	M	
Other	Geitonoplesium cymosum-Scrambling Lily	N	0.1	5	G	
Exotic	Syagrus romanzoffiana- Cocos Palm	E	0.3	20	M	
Other	Smilax australis-Lawyer Vine	N	2	10	G,M,U	
Exotic	Ambrosia Artemisiaefolia-Common Ragweed	E	6		G	
Forb	Alpinia caerulea-Native Ginger	N	0.5	2	G	
HTE	Ipomoea cairica- Coastal Morning Glory	HTE	10		G,M	
Other	Parsonsia straminea-Common Silkpod	N	0.1	4	M	
HTE	Asparagus aethiopicus-Ground Asparagus	HTE	0.5	10	G	
Forb	Alocasia brisbanensis-Cunjevoi	N	0.1	1	G	
Tree	Ficus coronata-Creek Sandpaper Fig	N	0.2	2	M	
Other	Maclura cochinchinensis-Cockspur Thorn	N	5	5	G,M,U	
HTE	Bidens pilosa-Cobblers Pegs	HTE	10		G	
Exotic	Hypochaeris glabra-Smooth Catsear	E	0.1	1	G	
Exotic	Ageratum conyzoides subsp. Conyzoides-Goatweed	E	2	20	G	
HTE	Chloris gayana- Rhodes Grass	HTE	0.5	20	G	
Exotic	Stelitzia sp-Strelizia	E	0.1	1	G	
HTE	Ochna serrulata-Mickey Mouse Plant	HTE	1	15	G	
HTE	Lantana camara- Lantana	HTE	2	3	M	
Tree	Glochidion ferdinandi-Cheese Tree	N	0.1	1	G	
HTE	Chrysanthemoides monilifera- Bitou Bush	HTE	0.2	1	G	
Forb	Oxalis sp.-Oxalis	N	0.1	1	G	
Exotic	Murraya paniculata-Murraya	E	2	10	M	
Exotic	Setaria sphacelata- Setaria	E	1	20	G	
HTE	Ipomoea purpurea- Common Morning Glory	HTE	10		G,M	
Exotic	Passiflora subpeltata-White Passionflower	E	2	20	G,M	
Exotic	Triumfetta rhomboidea- Chinese Bur	E	20		G	
Exotic	Paspalum conjugatum- Sour Grass	E	1	30	G	
Exotic	Vicia tetrasperma-Slender Vetch	E	0.1	5	G	
Exotic	Conyza bonariensis- Flaxleaf Fleabane	E	0.1	1	G	
Other	Hibbertia scandens-Climbing Guinea Flower	N	0.5	20	G	
Exotic	Tagetes minuta- Stinking Roger	E	1	10	G	
Exotic	Desmodium intortum-Green-leaved Desmodium	E	5	10	G	
HTE	Ageratina riparia- Mistflower	HTE	0.1	4	G	
Tree	Notelaea longifolia-Large Mock-olive	N	2	2	M	

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 15 / 08 / 18	TVH	101	Damian Licari and Christina Maloney

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
Tree	Glochidion sumatranum-Umbrella Cheese Tree	N	0.1	5	G	
Other	Marsdenia rostrata- Milk Vine	N	0.1	10	G,M	
Shrub	Myrsine variabilis- Muttonwood	N	2	10	M	
HTE	Melinis minutiflora-Molasses Grass	HTE	10		G	
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
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	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

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BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	15 / 08 / 18	TVH	Veg Zone 5	Damian Licari and Christina Maloney			
Zone 56	Datum GDA1994	Plot ID	102	Plot dimensions	10mX100m	Photo #	
Easting 555362	Northing 6873160	IBRA region	Burringbar-Conondale Ranges	Midline bearing from 0 m	13 Magnetic °		
Vegetation Class		North Coast Wet Sclerophyll Forests				Confidence: H M L	
Plant Community Type		1569		EEC: No		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of **Native Richness**	Trees	3
	Shrubs	0
	Grasses etc.	0
	Forbs	1
	Ferns	0
	Other	4
Sum of **Cover** of native vascular plants by growth form group	Trees	70
	Shrubs	0
	Grasses etc.	0
	Forbs	0.1
	Ferns	0
	Other	14.3
High Threat Weed cover		62.6

BAM Attribute (1000 m² plot)		
DBH	**# Tree Stems Count**	**# Stems with Hollows**
80 + cm	5	1
50 – 79 cm	Present	
30 – 49 cm	present	
20 – 29 cm	present	
10 – 19 cm	present	
5 – 9 cm	present	
< 5 cm	present	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	146 Tally space	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	80	95	95	97	100	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	93.4																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m^2 plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 15 / 08 / 18	TVH	102	Damian Licari and Christina Maloney

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
Exotic	Syagrus romanzoffiana- Cocos Palm	E	4	3	M,U	
Tree	Macaranga tanarius-Blush Macaranga	N	20		M,U	
Tree	Eucalyptus grandis- Flooded Gum	N	40		U	
Tree	Guioa semiglauca-Guioa	N	10		M,U	
HTE	Cinnamomum camphora- Camphor Laurel	HTE	35		M,U	
Other	Maclura cochinchinensis-Cockspur Thorn	N	4	10	G,M,U	
Other	Smilax australis-Lawyer Vine	N	10		G,M,U	
HTE	Bidens pilosa- Cobblers Pegs	HTE	15		G	
HTE	Schefflera actinophylla- Umbrella Tree	HTE	0.5	3	M,U	
HTE	Ochna serrulata- Mickey Mouse Plant	HTE	0.5	10	G	
Exotic	Solanum nigrum- Black-berry Nightshade	E	0.2	15	G	
Exotic	Murraya paniculata- Murraya	E	0.3	10	M,U	
HTE	Lantana camara- Lantana	HTE	0.2	5	G,M	
HTE	Asparagus aethiopicus- Ground Asparagus	HTE	0.1	3	G	
HTE	Ligustrum sinense- Small-leaved Privet	HTE	0.5	6	G,M	
HTE	Senna pendula- Senna	HTE	0.5	10	M,U	
HTE	Tradescantia fluminensis- Trad	HTE	0.1	10	G	
Forb	Oxalis sp.- Oxalis	N	0.1	1	G	
Exotic	Triumfetta rhomboidea- Chinese Bur	E	10		G	
Other	Hibbertia scandens-Climbing Guinea Flower	N	0.1	2	G	
Exotic	Passiflora subpeltata- White Passionflower	E	1	3	G,M	
Exotic	Cestrum nocturnum- Lady of the Night	E	0.5	5	G,M	
Other	Stephania japonica-Snake vine	N	0.2	3	G,M	
Exotic	Passiflora suberosa- Cork Passionflower	E	0.5	15	G,M	
HTE	Ageratina riparia- Mistflower	HTE	0.2	5	G	
HTE	Melinis minutiflora- Molasses Grass	HTE	10		G	
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

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BAM Site – Field Survey Form

Site Sheet no: 1 of 2

		Survey Name	Zone ID	Recorders			
Date	03 / 09 / 18	TVH	Veg Zone 3	Annette McKinley and Christina Maloney			
Zone 56	Datum GDA1994	Plot ID	103	Plot dimensions	20mX50m	Photo #	
Easting 555433	Northing 6873550	IBRA region	Burringbar-Conondale Ranges	Midline bearing from 0 m	68 Magnetic °		
Vegetation Class		Subtropical Rainforests				Confidence: H M L	
Plant Community Type		1302		EEC: Yes		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of **Native Richness**	**Trees**	8
	Shrubs	3
	Grasses etc.	0
	Forbs	0
	Ferns	0
	Other	5
Sum of **Cover** of native vascular plants by growth form group	**Trees**	31.5
	Shrubs	0.7
	Grasses etc.	0
	Forbs	0
	Ferns	0
	Other	1.7
High Threat Weed cover		19.1

BAM Attribute (1000 m² plot)		
DBH	**# Tree Stems Count**	**# Stems with Hollows**
80 + cm	0	0
50 – 79 cm	0	
30 – 49 cm	present	
20 – 29 cm	present	
10 – 19 cm	present	
5 – 9 cm	present	
< 5 cm	present	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	38.5 Tally space	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30…, 100, 200, 300…). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	85	75	75	95	95	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	85																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)	0		
Cultivation (inc. pasture)	1		Edge of plot
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness	2		Lantana camera, Madeira vine, elephant grass, Bidens pilosa
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	03 / 09 / 18	TVH	103	Annette McKinley and Christina Maloney

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
Tree	Guioa semiglauca-Guioa	N	8		M,U	
Tree	Macaranga tanarius-Blush Macaranga	N	10		M,U	
Tree	Diospyros fasciculosa-Grey Ebony	N	0.5	1	U	
HTE	Ligustrum sinense- Small-leaved Privet	HTE	10		G,M	
Exotic	Rivina humilis- Coral Berry	E	1	50	G	
HTE	Ipomoea cairica- Coastal Morning Glory	HTE	1	10	G,M,U	
Tree	Mallotus philippensis-Red Kamala	N	2	2	M	
HTE	Lantana camara-Lantana	HTE	4	2	G,M	
Other	Mucuna gigantea subsp. gigantea-Burny Bean	N	0.5	4	G,M,U	
Exotic	Passiflora edulis- Common Passionfruit	E	0.1	1	G,M,U	
HTE	Ochna serrulata- Mickey Mouse Plant	HTE	1	10	G	
Other	Trophis scandens-Burny Vine	N	0.1	2	G,M	
HTE	Bidens pilosa- Cobblers Pegs	HTE	3	500	G	
HTE	Senna pendula- Senna	HTE	0.1	2	M	
Exotic	Persea americana-avocado	E	0.5	2	M	
Tree	Commersonia bartramia-Brown Kurrajong	N	3	2	M,U	
Exotic	Cenchrus purpureus- Barner Grass	E	10		G	
Exotic	Solanum mauritianum- Wild Tobacco Bush	E	0.5	3	M	
Exotic	Murraya paniculata-Murraya	E	0.1	1	M	
Tree	Ficus fraseri-Sandpaper Fig	N	1	1	M	
Exotic	Cestrum sp. Cestrum	E	1	1	M	
Other	Cordyline congesta- Narrow-leaved Palm Lily	N	0.5	3	G	
Shrub	Eupomatia bennettii-Small Bolwarra	N	0.1	1	M	
Exotic	Passiflora suberosa- Cork Passionflower	E	0.1	2	G,M,U	
Tree	Cryptocarya triplinervis var. triplinervis-3 veined laurel	N	1	5	G,M	
Other	Flagellaria indica-Whip Vine	N	0.5	1	M,U	
Shrub	Capparis arborea-Native Pomegranate	N	0.5	1	M	
Shrub	Tabernaemontana pandacaqui-Banana Bush	N	0.1	1	M	
Other	Maclura cochinchinensis-Cockspur Thorn	N	0.1	1	G,M,U	
Exotic	Monstera deliciosa-Fruit Salad Plant	E	0.2	1	G	
Exotic	Paspalum mandiocanum-Boradleaf Paspalum	E	0.1	1	G	
Tree	Macadamia integrifolia <-> tetraphylla hybrid	N	6	5	M,U	
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

APPENDIX C. FLORISTIC VEGETATION SURVEY SUMMARY OF RESULTS

Plot Name	Scientific Name	Common Name	Growth Form Group	Stratum	Species Type	Cover	Abundance
Plot 19							
19	*Baumea rubiginosa*	Soft twigrush	Grass or grass like	G	Native	0.5	30
19	*Blechnum indicum*	Swamp Water Fern	Fern	G	Native	50	-
19	*Crinum pedunculatum*	Swamp Lily	Forb	G, M	Native	0.1	3
19	*Glochidion ferdinandi*	Cheese Tree	Tree	G	Native	0.1	1
19	*Hibiscus diversifolius*	Swamp Hibiscus	Shrub	M	Native	0.2	2
19	*Hypolepis muelleri*	Harsh Ground Fern	Fern	G	Native	0.1	2
19	*Ipomoea cairica*	Coastal Morning Glory	N/A	G, M	Hight Threat Exotic	10	-
19	*Lygodium microphyllum*	Climbing Snake Fern	Fern	M	Native	0.3	2
19	*Macaranga tanarius*	Blush Macaranga	Tree	G	Native	0.1	1
19	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Tree	U	Native	30	-
19	*Melicope elleryana*	Pink-flowered Doughwood	Tree	M	Native	0.1	1
19	*Parsonsia straminea*	Common Silkpod	Other	U	Native	15	-
19	*Paspalum conjugatum*	Sour Grass	N/A	G	Exotic	40	-
19	*Persicaria dichotoma*	Blume	Forb	G	Native	0.1	3
19	*Persicaria sp.*	Persicaria	Forb	G	Native	10	-
19	*Persicaria strigosa*	Spotted Knotweed	Forb	G	Native	20	-
19	*Phragmites australis*	Common Reed	Grass or grass like	G	Native	10	-
19	*Solanum americanum*	Glossy Nightshade	Forb	G	Native	0.1	2

Growth Form Group	Count of Native Species Richness	Sum of Cover
Tree	4	30.3
Shrub	1	0.2
Forb	5	30.3
Grass or grass like	2	10.5
Fern	3	50.4
Other	1	15
High Threat Weed Cover	10	
DBH (cm)	**Stem Count**	
>80 cm	0	
50-79	0	
30-49	Present	
20-29	Present	
10-19	Present	
5-9	Absent	
<5	Present	
Stems with hollow (No.)	0	
Length of logs (m)	253.5	
Litter plot	**Litter cover**	
1	100	
2	100	
3	100	
4	100	
5	100	
Average	100	

Plot 16							
16	*Archontophoenix cunninghamiana*	Bangalow Palm	Other	M	Native	10	-
16	*Baumea rubiginosa*	Soft twigrush	Grass or grass like	G	Native	5	100
16	*Blechnum indicum*	Swamp Water Fern	Fern	G	Native	90	-
16	*Carex appressa*	Tall Sedge	Grass or grass like	G	Native	5	40
16	*Cinnamomum camphora*	Camphor Laurel	N/A	G, M	Hight Threat Exotic	3	20
16	*Ficus coronata*	Creek Sandpaper Fig	Shrub	M	Native	0.2	3
16	*Ficus macrophylla*	Moreton Bay Fig	Tree	M	Native	1	3
16	*Ficus obliqua*	Small-leaved Fig	Tree	M	Native	0.5	1
16	*Glochidion ferdinandi var.pubens*	Cheese Tree	Tree	G	Native	0.3	1
16	*Hypolepis muelleri*	Harsh Ground Fern	Fern	G	Native	30	-
16	*Ipomoea cairica*	Coastal Morning Glory	N/A	G, M	Hight Threat Exotic	10	-
16	*Leersia hexandra*	Swamp Ricegrass	Grass or grass like	G	Native	10	-
16	*Lepironia articulata*	Grey Rush	Grass or grass like	G	Native	10	-
16	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Tree	U	Native	20	-
16	*Melicope elleryana*	Pink-flowered Doughwood	Tree	M	Native	5	4
16	*Myrsine Howittiana*	Brush Muttonwood	Shrub	M	Native	0.5	1
16	*Parsonsia straminea*	Common Silkpod	Other	U	Native	15	-
16	*Persicaria strigosa*	Spotted Knotweed	Forb	G	Native	10	-
16	*Phragmites australis*	Common Reed	Grass or grass like	G	Native	10	-
16	*Schefflera actinophylla*	Umbrella Tree	N/A	M	Hight Threat Exotic	0.5	1

Growth Form Group	Count of Native Species Richness	Sum of Cover
Tree	5	26.8
Shrub	2	0.7
Forb	1	10
Grass or grass like	5	40
Fern	2	120
Other	2	25
High Threat Weed Cover	13.5	
DBH (cm)	**Stem Count**	
>80 cm	0	
50-79	0	
30-49	Present	
20-29	Present	
10-19	Present	
5-9	Present	
<5	Present	
Stems with hollow (No.)	1	
Length of logs (m)	252	
Litter plot	**Litter cover**	
1	95	
2	70	
3	80	
4	95	
5	100	
Average	88	

Plot 11							
11	*Acmena smithii*	Lilly Pilly	Tree	M	Native	3	1
11	*Alocasia brisbanensis*	Cunjevoi	Forb	G	Native	2	10
11	*Alpinia caerulea*	Native Ginger	Forb	G	Native	1	10
11	*Archontophoenix alexandrae*	Alexandra Palm	N/A	G,M, U	Exotic	56	-

Growth Form Group	Count of Native Species Richness	Sum of Cover
Tree	6	110.1
Shrub	0	0
Forb	2	3

Plot Name	Scientific Name	Common Name	Growth Form Group	Stratum	Species Type	Cover	Abundance
11	*Archontophoenix cunninghamiana*	Bangalow Palm	Other	G,M, U	Native	14	-
11	*Christella dentata*	Binung	Fern	G	Native	0.2	2
11	*Cinnamomum camphora*	Camphor Laurel	N/A	M	Hight Threat Exotic	0.1	2
11	*Cordyline congesta*	Narrow-leaved Palm Lily	Other	G, M	Native	0.1	2
11	*Ficus coronata*	Creek Sandpaper Fig	Tree	M	Native	2	3
11	*Ficus macrophylla*	Moreton Bay Fig	Tree	U	Native	80	-
11	*Ficus obliqua*	Small-leaved Fig	Tree	U	Native	20	-
11	*Flagellaria indica*	Whip Vine	Other	U	Native	15	-
11	*Ipomoea indica*	Morning Glory	N/A	M, U	Hight Threat Exotic	2	5
11	*Lantana camara*	Lantana	N/A	G, M	Hight Threat Exotic	0.2	2
11	*Ligustrum sinense*	Small-leaved Privet	N/A	G, M	Hight Threat Exotic	2	5
11	*Macaranga tanarius*	Blush Macaranga	Tree	G	Native	0.1	5
11	*Maclura cochinchinensis*	Cockspur Thorn	Other	G, M, U	Native	10	-
11	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Tree	M	Native	5	1
11	*Mucuna gigantea subsp. gigantea*	Burny Bean	Other	G, M	Native	0.2	5
11	*Murraya paniculata*	Murraya	N/A	G, M	Exotic	0.4	1
11	*Ochna serrulata*	Mickey Mouse Plant	N/A	G	Hight Threat Exotic	0.1	2
11	*Oplismenus aemulus*	Australian Basket Grass	Grass or grass like	G	Native	0.1	5
11	*Schefflera actinophylla*	Umbrella Tree	N/A	G, M	Hight Threat Exotic	5	10
11	*Smilax australis*	Lawyer Vine	Other	M, U	Native	0.1	5
11	*Solanum chrysotrichum*	Devil's Fig	N/A	G	Exotic	0.1	2
11	*Solanum mauritianum*	Wild Tobacco Bush	N/A	M	Exotic	0.2	1

Grass or grass like	1
Fern	1
Other	6
High Threat Weed Cover	9.4
DBH (cm)	**Stem Count**
>80 cm	2
50-79	2
30-49	Present
20-29	Present
10-19	Present
5-9	Present
<5	Present
Stems with hollow (No.)	3
Length of logs (m)	119.5
Litter plot	**Litter cover**
1	80
2	75
3	95
4	100
5	100
Average	90

Plot 99							
99	*Asparagus aethiopicus*	Ground Asparagus	N/A	G	Hight Threat Exotic	10	-
99	*Bidens pilosa*	Cobblers Pegs	N/A	G	Hight Threat Exotic	2	20
99	*Chloris gayana*	Rhodes Grass	N/A	G	Hight Threat Exotic	10	-
99	*Cinnamomum camphora*	Camphor Laurel	N/A	M, U	Hight Threat Exotic	10	-
99	*Cupaniopsis anacardioides*	Tuckeroo	Tree	M, U	Native	10	2
99	*Macaranga tanarius*	Blush Macaranga	Tree	M, U	Native	80	-
99	*Ochna serrulata*	Mickey Mouse Plant	N/A	G	Hight Threat Exotic	5	10
99	*Parsonsia straminea*	Common Silkpod	Other	U	Native	1	1
99	*Schefflera actinophylla*	Umbrella Tree	N/A	M, U	Hight Threat Exotic	5	4
99	*Sonchus asper*	Prickly Sowthistle	N/A	G	Exotic	0.1	5
99	*Strelizia Sp.*	Strelizia	N/A	G	Exotic	0.1	1

Growth Form Group	Count of Native Species Richness	Sum of Cover
Tree	2	90
Shrub	0	0
Forb	0	0
Grass or grass like	0	0
Fern	0	0
Other	1	1
High Threat Weed Cover	42	
DBH (cm)	**Stem Count**	
>80 cm	0	
50-79	0	
30-49	Present	
20-29	Present	
10-19	Present	
5-9	Present	
<5	Present	
Stems with hollow (No.)	0	
Length of logs (m)	34.5	
Litter plot	**Litter cover**	
1	85	
2	40	
3	10	
4	70	
5	50	
Average	51	

Plot 98							
98	*Amylotheca dictyophleba*	Brush Mistletoe	Other	M	Native	0.2	5
98	*Archontophoenix cunninghamiana*	Bangalow Palm	Other	G, M	Native	0.5	1
98	*Asparagus aethiopicus*	Ground Asparagus	N/A	G	Hight Threat Exotic	10	-
98	*Bidens pilosa*	Cobblers Pegs	N/A	G	Hight Threat Exotic	5	50
98	*Chloris gayana*	Rhodes Grass	N/A	G	Hight Threat Exotic	1	20
98	*Cinnamomum camphora*	Camphor Laurel	N/A	M, U	Hight Threat Exotic	5	5
98	*Cryptocarya triplinervis var. triplinerv*	Three-veined laurel	Tree	M	Native	2	5
98	*Cupaniopsis anacardioides*	Tuckeroo	Tree	M,	Native	4	3

Growth Form Group	Count of Native Species Richness	Sum of Cover
Tree	6	42
Shrub	0	0
Forb	0	0
Grass or grass like	0	0
Fern	0	0
Other	5	4.7
High Threat Weed Cover	106	

Plot Name	Scientific Name	Common Name	Growth Form Group	Stratum	Species Type	Cover	Abundance
98	*Eragrostis tenuifolia*	Elastic Grass	N/A	G	Exotic	10	-
98	*Guioa semiglauca*	Guioa	Tree	M	Native	3	5
98	*Ipomoea cairica*	Coastal Morning Glory	N/A	M, U	Hight Threat Exotic	5	10
98	*Macaranga tanarius*	Blush Macaranga	Tree	M	Native	30	-
98	*Maclura cochinchinensis*	Cockspur Thorn	Other	G, M	Native	1	1
98	*Mallotus discolor*	White Kamala	Tree	M	Native	1	1
98	*Mallotus philippensis*	Red Kamala	Tree	M	Native	2	3
98	*Murraya paniculata*	Murraya	N/A	M	Exotic	0.5	2
98	*Ochna serrulata*	Mickey Mouse Plant	N/A	M	Hight Threat Exotic	2	5
98	*Parsonsia straminea*	Common Silkpod	Other	M, U	Native	2	3
98	*Pinus elliottii*	Slash Pine	N/A	U	Hight Threat Exotic	75	-
98	*Rhaphiolepis indica*	Indian Hawthorn	N/A	M	Exotic	1	1
98	*Schefflera actinophylla*	Umbrella Tree	N/A	M, U	Hight Threat Exotic	2	5
98	*Senna pendula*	Senna	N/A	M	Hight Threat Exotic	1	1
98	*Smilax australis*	Lawyer Vine	Other	M, U	Native	1	3
98	*Syagrus romanzoffiana*	Cocos Palm	N/A	M	Exotic	2	1

DBH (cm)	Stem Count
>80 cm	0
50-79	0
30-49	Absent
20-29	Present
10-19	Present
5-9	Present
<5	Present
Stems with hollow (No.)	0
Length of logs (m)	0
Litter plot	Litter cover
1	100
2	40
3	100
4	60
5	100
Average	80

Plot 100							
100	*Bidens pilosa*	Cobblers Pegs	N/A	G	Hight Threat Exotic	10	-
100	*Callistemon viminalis*	Weeping Bottlebrush	Tree	M	Native	10	-
100	*Casuarina glauca*	Swamp Oak	Tree	U	Native	25	-
100	*Chloris gayana*	Rhodes Grass	N/A	G	Hight Threat Exotic	10	-
100	*Diplocyclos palmatus*	Native bryony	Other	M	Native	3	3
100	*Ipomoea cairica*	Coastal Morning Glory	N/A	M, U	Hight Threat Exotic	6	-
100	*Ipomoea indica*	Morning Glory	N/A	M, U	Hight Threat Exotic	3	10
100	*Lantana camara*	Lantana	N/A	M	Hight Threat Exotic	2	3
100	*Macaranga tanarius*	Blush Macaranga	Tree	M	Native	0.5	10
100	*Macroptilium atropurpureum*	Siratro	N/A	G	Exotic	2	3
100	*Mallotus philippensis*	Red Kamala	Tree	M	Native	0.3	1
100	*Megathyrsus maximus var. coloratus*	Guinea Grass	N/A	G	Exotic	15	-
100	*Melinis repens*	Red Natal Grass	N/A	G	Exotic	0.1	2
100	*Oxalis Sp.*	Oxalis	Forb	G	Native	0.1	1
100	*Passiflora subpeltata*	White Passionflower	N/A	G, M	Exotic	3	3
100	*Cenchrus purpureus*	Barner Grass	N/A	M	Exotic	35	-
100	*Ricinus communis*	Castor Oil Plant	N/A	M	Hight Threat Exotic	0.2	1
100	*Schefflera actinophylla*	Umbrella Tree	N/A	M	Hight Threat Exotic	0.1	1
100	*Senna pendula*	Senna	N/A	M	Hight Threat Exotic	2	5
100	*Solanum mauritianum*	Wild Tobacco Bush	N/A	M	Exotic	5	4
100	*Sonchus asper*	Prickly Sowthistle	N/A	G	Exotic	0.1	5
100	*Triumfetta rhomboidea*	Chinese Bur	N/A	G	Exotic	0.2	20

Growth Form Group	Count of Native Species Richness	Sum of Cover
Tree	4	35.8
Shrub	0	0
Forb	1	0.1
Grass or grass like	0	0
Fern	0	0
Other	1	3
High Threat Weed Cover	33.3	
DBH (cm)	Stem Count	
>80 cm	0	
50-79	1	
30-49	Present	
20-29	Present	
10-19	Present	
5-9	Present	
<5	Present	
Stems with hollow (No.)	0	
Length of logs (m)	9.5	
Litter plot	Litter cover	
1	85	
2	95	
3	90	
4	95	
5	95	
Average	92	

Plot 101							
101	*Ageratina riparia*	Mistflower	N/A	G	Hight Threat Exotic	0.1	4
101	*Ageratum conyzoides subsp. Conyzoi*	Goatweed	N/A	G	Exotic	2	20
101	*Alocasia brisbanensis*	Cunjevoi	Forb	G	Native	0.1	1
101	*Alpinia caerulea*	Native Ginger	Forb	G	Native	0.5	2
101	*Ambrosia Artemisiaefolia*	Common Ragweed	N/A	G	Exotic	6	-
101	*Asparagus aethiopicus*	Ground Asparagus	N/A	G	Hight Threat Exotic	0.5	10
101	*Bidens pilosa*	Cobblers Pegs	N/A	G	Hight Threat Exotic	10	-
101	*Chloris gayana*	Rhodes Grass	N/A	G	Hight Threat Exotic	0.5	20
101	*Chrysanthemoides monilifera*	Bitou Bush	N/A	G	Hight Threat Exotic	0.2	1
101	*Conyza bonariensis*	Flaxleaf Fleabane	N/A	G	Exotic	0.1	1
101	*Cryptocarya triplinervis*	Three-veined laurel	Tree	G, M	Native	6	-
101	*Desmodium intortum*	Green-leaved Desmodium	N/A	G	Exotic	5	10
101	*Eucalyptus grandis*	Flooded Gum	Tree	U	Native	40	-

Growth Form Group	Cover of Native Richness	Sum of Cover
Tree	8	78.4
Shrub	1	2
Forb	3	0.7
Grass or grass like	0	0
Fern	0	0
Other	6	7.8
High Threat Weed Cover	61.8	
DBH (cm)	Stem Count	
>80 cm	0	
50-79	Present	
30-49	Present	
20-29	Present	

Plot Name	Scientific Name	Common Name	Growth Form Group	Stratum	Species Type	Cover	Abundance
101	*Eucalyptus microcorys*	Tallowwood	Tree	U	Native	20	-
101	*Ficus coronata*	Creek Sandpaper Fig	Tree	M	Native	0.2	2
101	*Geitonoplesium cymosum*	Scrambling Lily	Other	G	Native	0.1	5
101	*Glochidion ferdinandi*	Cheese Tree	Tree	G	Native	0.1	1
101	*Glochidion sumatranum*	Umbrella Cheese Tree	Tree	G	Native	0.1	5
101	*Hibbertia scandens*	Climbing Guinea Flower	Other	G	Native	0.5	20
101	*Hypochaeris glabra*	Smooth Catsear	N/A	G	Exotic	0.1	1
101	*Ipomoea cairica*	Coastal Morning Glory	N/A	G, M	Hight Threat Exotic	10	-
101	*Ipomoea purpurea*	Common Morning Glory	N/A	G, M	Hight Threat Exotic	10	-
101	*Lantana camara*	Lantana	N/A	M	Hight Threat Exotic	2	3
101	*Macaranga tanarius*	Blush Macaranga	Tree	G, M	Native	10	-
101	*Maclura cochinchinensis*	Cockspur Thorn	Other	G, M, U	Native	5	5
101	*Marsdenia rostrata*	Milk Vine	Other	G, M	Native	0.1	10
101	*Melinis minutiflora*	Molasses Grass	N/A	G	Hight Threat Exotic	10	-
101	*Murraya paniculata*	Murraya	N/A	M	Exotic	2	10
101	*Myrsine variabilis*	Muttonwood	Shrub	M	Native	2	10
101	*Notelaea longifolia*	Large Mock-olive	Tree	M	Native	2	2
101	*Ochna serrulata*	Mickey Mouse Plant	N/A	G	Hight Threat Exotic	1	15
101	*Oxalis Sp.*	Oxalis	Forb	G	Native	0.1	1
101	*Parsonsia straminea*	Common Silkpod	Other	M	Native	0.1	4
101	*Paspalum conjugatum*	Sour Grass	N/A	G	Exotic	1	30
101	*Passiflora subpeltata*	White Passionflower	N/A	G, M	Exotic	2	20
101	*Schefflera actinophylla*	Umbrella Tree	N/A	M	Hight Threat Exotic	15	-
101	*Senna pendula*	Senna	N/A	M	Hight Threat Exotic	2	10
101	*Setaria sphacelata*	Setaria	N/A	G	Exotic	1	20
101	*Smilax australis*	Lawyer Vine	Other	G, M, U	Native	2	10
101	*Strelizia Sp.*	Strelizia	N/A	G	Exotic	0.1	1
101	*Syagrus romanzoffiana*	Cocos Palm	N/A	M	Exotic	0.3	20
101	*Tagetes minuta*	Stinking Roger	N/A	G	Exotic	1	10
101	*Triumfetta rhomboidea*	Chinese Bur	N/A	G	Exotic	20	-
101	*Vicia tetrasperma*	Slender Vetch	N/A	G	Exotic	0.1	5

Litter plot	Litter cover
10-19	Present
5-9	Present
<5	Present
Stems with hollow (No.)	1
Length of logs (m)	15
1	95
2	90
3	90
4	98
5	100
Average	94.6

Plot 102							
102	*Ageratina riparia*	Mistflower	N/A	G	Hight Threat Exotic	0.2	5
102	*Asparagus aethiopicus*	Ground Asparagus	N/A	G	Hight Threat Exotic	0.1	3
102	*Bidens pilosa*	Cobblers Pegs	N/A	G	Hight Threat Exotic	15	-
102	*Cestrum nocturnum*	Lady of the Night	N/A	G, M	Exotic	0.5	5
102	*Cinnamomum camphora*	Camphor Laurel	N/A	M, U	Hight Threat Exotic	35	-
102	*Eucalyptus grandis*	Flooded Gum	Tree	U	Native	40	-
102	*Guioa semiglauca*	Guioa	Tree	M, U	Native	10	-
102	*Hibbertia scandens*	Climbing Guinea Flower	Other	G	Native	0.1	2
102	*Lantana camara*	Lantana	N/A	G, M	Hight Threat Exotic	0.2	5
102	*Ligustrum sinense*	Small-leaved Privet	N/A	G, M	Hight Threat Exotic	0.5	6
102	*Macaranga tanarius*	Blush Macaranga	Tree	M, U	Native	20	-
102	*Maclura cochinchinensis*	Cockspur Thorn	Other	G, M, U	Native	4	10
102	*Melinis minutiflora*	Molasses Grass	N/A	G	Hight Threat Exotic	10	-
102	*Murraya paniculata*	Murraya	N/A	M, U	Exotic	0.3	10
102	*Ochna serrulata*	Mickey Mouse Plant	N/A	G	Hight Threat Exotic	0.5	10
102	*Oxalis Sp.*	Oxalis	Forb	G	Native	0.1	1
102	*Passiflora suberosa*	Cork Passionflower	N/A	G, M	Exotic	0.5	15
102	*Passiflora subpeltata*	White Passionflower	N/A	G, M	Exotic	1	3
102	*Schefflera actinophylla*	Umbrella Tree	N/A	M, U	Hight Threat Exotic	0.5	3
102	*Senna pendula*	Senna	N/A	M, U	Hight Threat Exotic	0.5	10
102	*Smilax australis*	Lawyer Vine	Other	G, M, U	Native	10	-
102	*Solanum nigrum*	Black-berry Nightshade	N/A	G	Exotic	0.2	15
102	*Stephania japonica*	Snake Vine	Other	G, M	Native	0.2	3
102	*Syagrus romanzoffiana*	Cocos Palm	N/A	M, U	Exotic	4	3
102	*Tradescantia fluminensis*	Trad	N/A	G	Hight Threat Exotic	0.1	10
102	*Triumfetta rhomboidea*	Chinese Bur	N/A	G	Exotic	10	-

Growth Form Group	Cover of Native Richness	Sum of Cover
Tree	3	70
Shrub	0	0
Forb	1	0.1
Grass or grass like	0	0
Fern	0	0
Other	4	14.3
High Threat Weed Cover	62.6	
DBH (cm)	**Stem Count**	
>80 cm	5	
50-79	Present	
30-49	Present	
20-29	Present	
10-19	Present	
5-9	Present	
<5	Present	
Stems with hollow (No.)	1	
Length of logs (m)	146	
Litter plot	**Litter cover**	
1	80	
2	95	
3	95	
4	97	
5	100	
Average	93.4	

Plot Name	Scientific Name	Common Name	Growth Form Group	Stratum	Species Type	Cover	Abundance
Plot 103							
103	*Bidens pilosa*	Cobblers Pegs	N/A	G	Hight Threat Exotic	3	500
103	*Capparis arborea*	Native Pomegranate	Shrub	M	Native	0.5	1
103	*Cestrum sp.*	Cestrum	N/A	M	Exotic	1	1
103	*Commersonia bartramia*	Brown Kurrajong	Tree	M, U	Native	3	2
103	*Cordyline congesta*	Narrow-Leaved Palm Lily	Other	G	Native	0.5	3
103	*Cryptocarya triplinervis var. triplinerv*	Three-veined laurel	Tree	G, M	Native	1	5
103	*Diospyros fasciculosa*	Grey Ebony	Tree	U	Native	0.5	1
103	*Eupomatia bennettii*	Small Bolwarra	Shrub	M	Native	0.1	1
103	*Ficus fraseri*	Sandpaper Fig	Tree	M	Native	1	1
103	*Flagellaria indica*	Whip Vine	Other	M, U	Native	0.5	1
103	*Guioa semiglauca*	Guioa	Tree	M, U	Native	8	-
103	*Ipomoea cairica*	Coastal Morning Glory	N/A	G, M, U	Hight Threat Exotic	1	10
103	*Lantana camara*	Lantana	N/A	G, M	Hight Threat Exotic	4	2
103	*Ligustrum sinense*	Small-leaved Privet	N/A	G, M	Hight Threat Exotic	10	-
103	*Macadamia integrifolia x tetraphylla*	Macadamia	Tree	M, U	Native	6	5
103	*Macaranga tanarius*	Blush Macaranga	Tree	M, U	Native	10	-
103	*Maclura cochinchinensis*	Cockspur Thorn	Other	G, M, U	Native	0.1	1
103	*Trophis scandens*	Burny Vine	Other	G, M	Native	0.1	2
103	*Mallotus philippensis*	Red Kamala	Tree	M	Native	2	2
103	*Monstera deliciosa*	Fruit Salad Plant	N/A	G	Exotic	0.2	1
103	*Mucuna gigantea subsp. Gigantea*	Burny Bean	Other	G, M, U	Native	0.5	4
103	*Murraya paniculata*	Murraya	N/A	M	Exotic	0.1	1
103	*Ochna serrulata*	Mickey Mouse Plant	N/A	G	Hight Threat Exotic	1	10
103	*Paspalum mandiocanum*	Broadleaf Paspalum	N/A	G	Exotic	0.1	1
103	*Passiflora edulis*	Common Passionfruit	N/A	G, M ,U	Exotic	0.1	1
103	*Passiflora suberosa*	Cork Passionflower	N/A	G, M, U	Exotic	0.1	2
103	*Cenchrus purpureus*	Barner Grass	N/A	G	Exotic	10	-
103	*Persea americana*	Avocado	N/A	M	Exotic	0.5	2
103	*Rivina humilis*	Coral Berry	N/A	G	Exotic	1	50
103	*Senna pendula*	Senna	N/A	M	Hight Threat Exotic	0.1	2
103	*Solanum mauritianum*	Wild Tobacco Bush	N/A	M	Exotic	0.5	3
103	*Tabernaemontana pandacaqui*	Banana Bush	Shrub	M	Native	0.1	1

Growth Form Group	Cover of Native Richness	Sum of Cover
Tree	8	31.5
Shrub	3	0.7
Forb	0	0
Grass or grass like	0	0
Fern	0	0
Other	5	1.7
High Threat Weed Cover	19.1	
DBH (cm)	**Stem Count**	
>80 cm	0	
50-79	0	
30-49	Present	
20-29	Present	
10-19	Present	
5-9	Present	
<5	Present	
Stems with hollow (No.)	0	
Length of logs (m)	38.5	
Litter plot	**Litter cover**	
1	85	
2	75	
3	75	
4	95	
5	95	
Average	85	

APPENDIX D. VEGETATION INTEGRITY SURVEY SUMMARY OF RESULTS

Plot Name	Date of Survey	Recorders	Veg Zone	PCT	EEC	Area	Patch Size	Plot Dimensions	Condition Class	Datum	Zone	Easting	Northing	Bearing	IBRA Bioregion	IBRA Subregion	Vegetation Formation	Vegetation Class	DBH <5cm	DBH 5cm to 9cm	DBH 10cm to 19cm	DBH 20cm to 29cm
19	15/06/2018	Damian Licari and Gina Minatel	1	1064	Yes	3.8	68	20m X 50m	Moderate	GDA1994	56	555890	6873927	350	South East QLD	Burringbar-Conondale Ranges	Forested Wetlands	Coastal Swamp Forests	yes	no	yes	yes
16	10/07/2018	Damian Licari and Gina Minatel	1	1064	Yes	3.8	68	20m X 50m	Moderate	GDA1994	56	555898	6873830	310	South East QLD	Burringbar-Conondale Ranges	Forested Wetlands	Coastal Swamp Forests	yes	yes	yes	yes
11	11/07/2018	Damian Licari and Gina Minatel	2	1302	Yes	1.0	68	20m X 50m	Moderate	GDA1994	56	555871	6873727	220	South East QLD	Burringbar-Conondale Ranges	Rainforests	Subtropical Rainforests	yes	yes	yes	yes
99	11/07/2018	Damian Licari and Gina Minatel	4	1302	No	0.6	68	10 x 100m	Derived	GDA1994	56	555489	6873425	178	South East QLD	Burringbar-Conondale Ranges	Rainforests	Subtropical Rainforests	yes	yes	yes	yes
98	12/07/2018	Damian Licari and Gina Minatel	8	1302	No	0.7	68	10 x 100m	Derived	GDA1994	56	555619	6873327	38	South East QLD	Burringbar-Conondale Ranges	Rainforests	Subtropical Rainforests	yes	yes	yes	yes
100	15/08/2018	Damian Licari and Christina Maloney	7	1235	No	0.1	68	10 x 100m	Derived	GDA1994	56	555953	6873675	174	South East QLD	Burringbar-Conondale Ranges	Forested Wetlands	Coastal Floodplain Wetlands	yes	yes	yes	yes
101	15/08/2018	Damian Licari and Christina Maloney	6	1569	No	0.2	68	20m X 50m	Derived	GDA1994	56	555957	6873725	255	South East QLD	Burringbar-Conondale Ranges	Wet sclerophyll	North Coast Wet Sclerophyll Forests	yes	yes	yes	yes
102	15/08/2018	Damian Licari and Christina Maloney	5	1569	No	0.5	68	10 x 100m	Derived	GDA1994	56	555362	6873160	13	South East QLD	Burringbar-Conondale Ranges	Wet sclerophyll	North Coast Wet Sclerophyll Forests	yes	yes	yes	yes
103	3/09/2018	Annette McKinley and Christina	3	1302	Yes	0.3	68	20m X 50m	Low	GDA1994	56	555433	6873550	68	South East QLD	Burringbar-Conondale Ranges	Rainforests	Subtropical Rainforests	yes	yes	yes	yes

Plot Name	DBH 30cm to 49cm	DBH 30cm to 49cm Count	DBH 50cm to 79cm	DBH 50cm to 79cm Count	DBH 80cm	DBH 80cm Count	Length of logs (m)	Hollow Trees Count	Litter Cover Plot 1	Litter Cover Plot 2	Litter Cover Plot 3	Litter Cover Plot 4	Litter Cover Plot 5
19	yes	0	no	0	no	0	253.5	0	100	100	100	100	100
16	yes	17	no	0	no	0	252	1	95	70	80	95	100
11	yes	7	yes	2	yes	2	119.5	3	80	75	95	100	100
99	yes	2	no	0	no	0	34.5	0	85	40	10	70	50
98	no	0	no	0	no	0	0	0	100	40	100	60	100
100	yes	0	yes	1	no	0	9.5	0	85	95	90	95	95
101	yes	9	yes	7	no	0	15	1	95	90	90	98	100
102	yes	0	yes	0	yes	5	146	1	80	95	95	100	97
103	yes	0	no	0	no	0	38.5	0	85	75	75	95	95

APPENDIX E. BAM PREDICTED SPECIES REPORT

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00011608/BAAS17014/19/00011609	Tweed Valley Hospital - Impact assessment calculations	04/01/2019
Assessor Name	**Report Created**	**BAM Data version ***
Damian Licari	22/01/2019	6
Assessor Number	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	
BAAS18006		

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barred Cuckoo-shrike	Coracina lineata	1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion
Eastern Bentwing-bat	Miniopterus schreibersii oceanensis	1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion
Eastern Freetail-bat	Mormopterus norfolkensis	1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion
Grey-headed Flying-fox	Pteropus poliocephalus	1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion
Little Bentwing-bat	Miniopterus australis	1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion
Northern Free-tailed Bat	Mormopterus lumsdenae	1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion
Powerful Owl	Ninox strenua	1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion
Red-legged Pademelon	Thylogale stigmatica	1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion
Spotted-tailed Quoll	Dasyurus maculatus	1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion
Superb Fruit-Dove	Ptilinopus superbus	1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion

BAM Predicted Species Report

APPENDIX F. BAM CANDIDATE SPECIES REPORT

BAM Candidate Species Report

Proposal Details

Assessment Id 00011608/BAAS17014/19/00011609	Proposal Name Tweed Valley Hospital - Impact assessment calculations	BAM data last updated * 04/01/2019
Assessor Name Damian Licari	Report Created 22/01/2019	BAM Data version * 6
Assessor Number BAAS18006	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	

List of Species Requiring Survey

Name	Presence	Survey Months
Acacia bakeri Marblewood	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Acalypha eremorum Acalypha	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Acronychia littoralis Scented Acronychia	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Niemeyera whitei Rusty Plum, Plum Boxwood	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Angiopteris evecta Giant Fern	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Archidendron hendersonii White Lace Flower	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Arthraxon hispidus Hairy Jointgrass	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Gossia fragrantissima Sweet Myrtle	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Belvisia mucronata Needle-leaf Fern	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Bosistoa transversa Yellow Satinheart	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Coeranoscincus reticulatus Three-toed Snake-tooth Skink	Yes (assumed present)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Cassia marksiana Cassia marksiana	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Corokia whiteana Corokia	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Cercartetus nanus Eastern Pygmy-possum	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Cryptocarya foetida Stinking Cryptocarya	Yes (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Cupaniopsis serrata Smooth Tuckeroo	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Cyclopsitta diophthalma coxeni Coxen's Fig-Parrot	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Choricarpia subargentea Giant Ironwood	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Cynanchum elegans White-flowered Wax Plant	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Cyperus semifertilis Missionary Nutgrass	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Davidsonia jerseyana Davidson's Plum	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Davidsonia johnsonii Smooth Davidson's Plum	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Dendrocnide moroides Gympie Stinger	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Desmodium acanthocladum Thorny Pea	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Diospyros mabacea Red-fruited Ebony	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Diospyros yandina Shiny-leaved Ebony	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Diploglottis campbellii Small-leaved Tamarind	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Drynaria rigidula Basket Fern	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Sarcochilus weinthalii Blotched Sarcochilus	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Senna acclinis Rainforest Cassia	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Sophora fraseri Brush Sophora	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Tinospora tinosporoides Arrow-head Vine	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Ozothamnus vagans Wollumbin Dogwood	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Xylosma terrae-reginae Queensland Xylosma	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Peristeranthus hillii Brown Fairy-chain Orchid	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Eidothea hardeniana Nightcap Oak	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Elaeocarpus williamsianus Hairy Quandong	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Endiandra floydii Crystal Creek Walnut	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Endiandra hayesii Rusty Rose Walnut	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Endiandra muelleri subsp. bracteata Green-leaved Rose Walnut	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Floydia praealta Ball Nut	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Fontainea australis Southern Fontainea	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Coatesia paniculata Axe-Breaker	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Grevillea hilliana White Yiel Yiel	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Hicksbeachia pinnatifolia Red Boppel Nut	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Hoplocephalus bitorquatus Pale-headed Snake	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Isoglossa eranthemoides Isoglossa	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Lepiderema pulchella Fine-leaved Tuckeroo	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Lindsaea brachypoda Short-footed Screw Fern	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Macadamia tetraphylla Rough-shelled Bush Nut	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Marsdenia longiloba Slender Marsdenia	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Melicope vitiflora Coast Euodia	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Niemeyera chartacea Smooth-leaved Plum	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Ninox strenua Powerful Owl	Yes (assumed present)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Oberonia complanata Yellow-flowered King of the Fairies	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Ochrosia moorei Southern Ochrosia	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Owenia cepiodora Onion Cedar	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Phyllanthus microcladus Brush Sauropus	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Planigale maculata Common Planigale	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Pomaderris notata McPherson Range Pomaderris	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Randia moorei Spiny Gardenia	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Myrsine richmondensis Ripple-leaf Muttonwood	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Symplocos baeuerlenii Small-leaved Hazelwood	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Syzygium hodgkinsoniae Red Lilly Pilly	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Syzygium moorei Durobby	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Thersites mitchellae Mitchell's Rainforest Snail	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

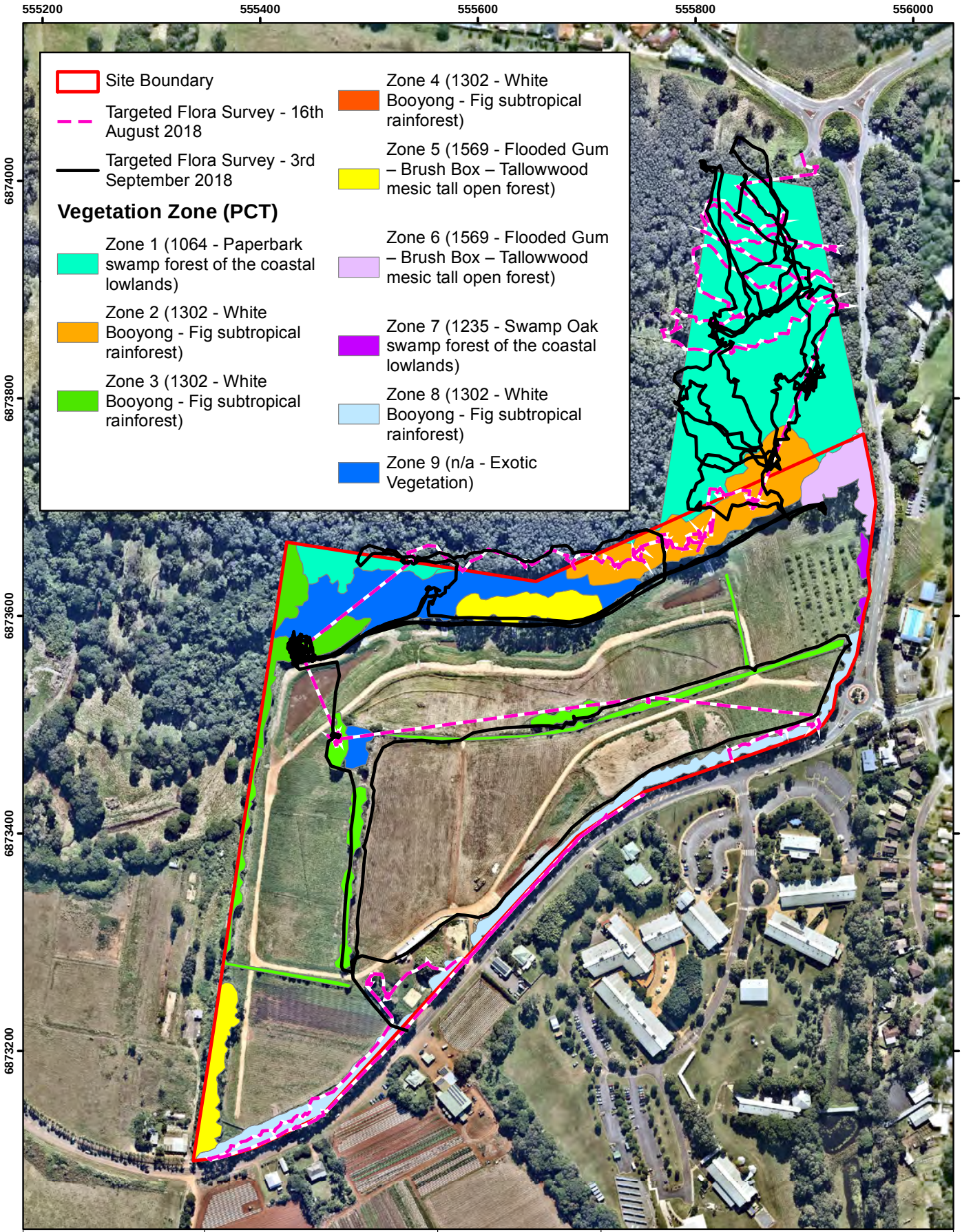
List of Species Not On Site

Name
Harnieria hygrophiloides Harnieria hygrophiloides
Doryanthes palmeri Giant Spear Lily
Litoria brevipalmata Green-thighed Frog
Miniopterus australis Little Bentwing-bat
Miniopterus schreibersii oceanensis Eastern Bentwing-bat
Mixophyes iteratus Giant Barred Frog
Myotis macropus Southern Myotis
Phyllodes imperialis southern subspecies Southern Pink Underwing Moth
Pteropus poliocephalus Grey-headed Flying-fox

Stage 2 SSD: Biodiversity Development Assessment Report

Tweed Valley Hospital

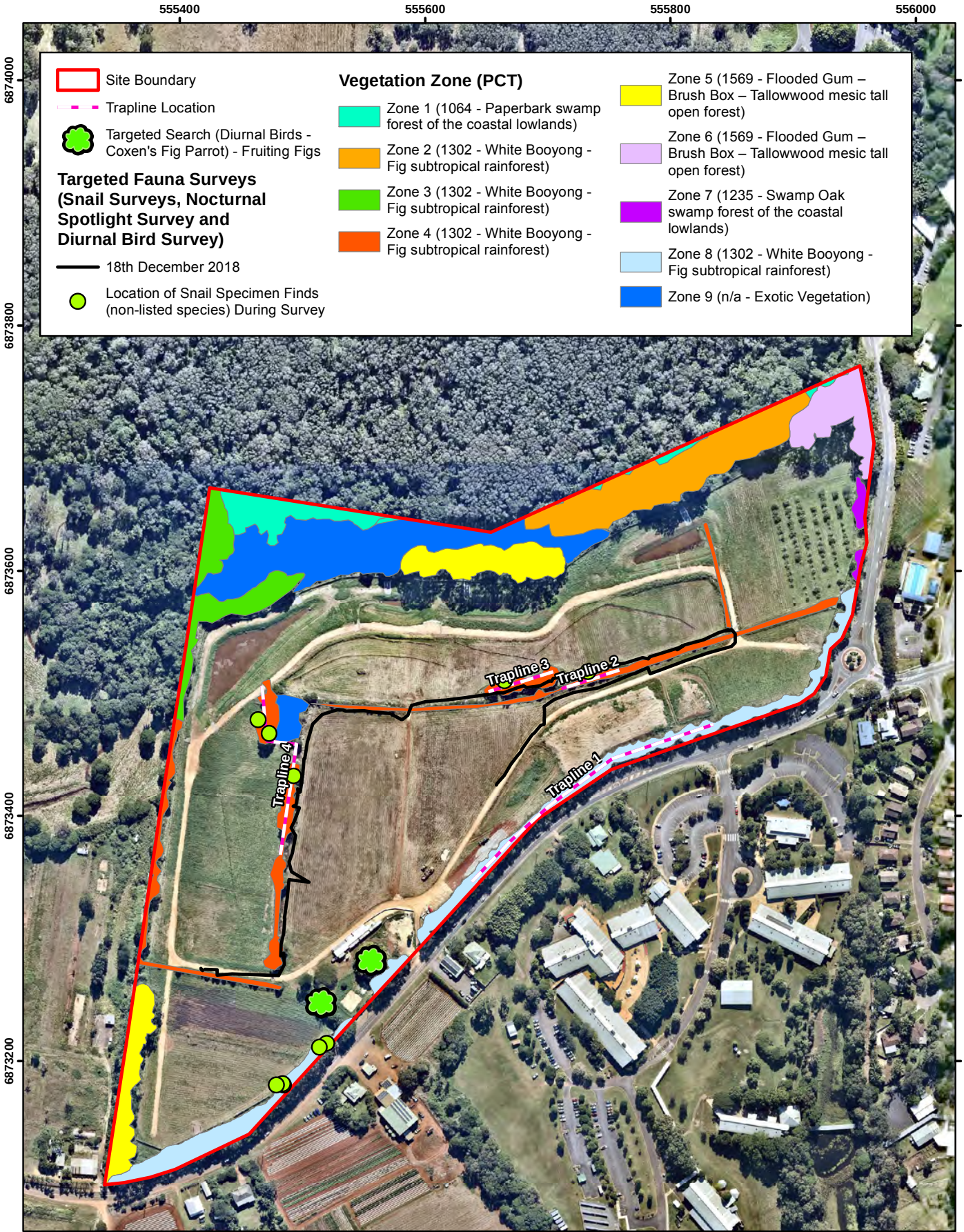
APPENDIX G. THREATENED SPECIES SURVEY RESULTS



Client: C107778	N 0 50 100 m	Scale (@A4): 1:4,500	**Survey Efforts - Flora**
Job #: J156455-13			
Author: D. Correa	Coordinate System: GDA 1994 MGA Zone 56		
Checked: C. Maloney	*Imagery 15th July 2019 (7.5 cm) © Nearmap 2019*	Tweed Valley Hospital Stage 2 BDAR 771 Cudgen Road Cudgen NSW	**Figure G-1**
Date: 8/08/2019	*Vegetation mapping: Greencap (2018)*		
GREENCAP			

No warranty is given in relation to the data (including accuracy, reliability, completeness or suitability) and accept no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of or reliance upon the data. Data must not be used for direct marketing or be used in breach of privacy laws.

Doc Path: \\ser2bne1\Brisbane_Projects\C107778_Health Infrastructure\J156455_Tweed Valley Hospital\3. Job Folder\GIS\J156455_13_TVHs2\BDARs2\mxd\J156455_13_BDARs2_zG01_survey_effort_flora_190801.mxd



Client: C107778	N 0 50 100 m	Scale (@A4): 1:4,000	**Fauna Survey Effort**
Job #: J156455-13			
Author: D. Correa	Coordinate System: GDA 1994 MGA Zone 56		
Checked: C. Maloney	*Imagery 15th July 2019 (7.5 cm) @ Nearmap 2019*	Tweed Valley Hospital Stage 2 BDAR 771 Cudgen Road Cudgen NSW	**Figure G-2**
Date: 8/08/2019	*Vegetation mapping: Greencap (2018)*		
GREENCAP			

No warranty is given in relation to the data (including accuracy, reliability, completeness or suitability) and accept no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of or reliance upon the data. Data must not be used for direct marketing or be used in breach of privacy laws.

Doc Path: \\ser2bne1\Brisbane_Projects\C107778_Health Infrastructure\J156455_Tweed Valley Hospital\3. Job Folder\GIS\J156455_13_TVHs2\BDARs2\mxd\J156455_13_BDARs2_zG02_fauna_survey_effort_190801.mxd

Targeted survey - Candidate threatened flora					
Date	**Start time**	**Finish time**	**Survey effort (hours)**	**Observer**	**Weather**
16/08/2018	8:00 AM	4:00 PM	16.0	Dr Damian Licari Annette McKinley	
3/09/2018	8:00 AM	4:00 PM	16.0	Annette McKinley Christina Maloney	
17/12/2018	8:00 AM	12:00 PM	4.0	Dr Barbara Stewart	Overcast, drizzle

Results 16/08/18					
Waypoint	**Easting**	**Northing**	**No. of specimens**	**Species**	**Notes**
056	555803	6873662	1	*Cryptocarya foetida*	

Results 17/12/18					
Waypoint	**Easting**	**Northing**	**No. of specimens**	**Species**	**Notes**
081	555683	6873386	1	*Cryptocarya foetida*	
082	555794	6873457	1	*Cryptocarya foetida*	

Targeted survey - Common planigale					
		Start		Finish	
Trapline	No. of traps	Easting	Northing	Easting	Northing
1	25	555638	6873346	555834	6873479
2	6	555756	6873523	555709	6873508
3	6	555701	6873522	555648	6873506
4	13	555467	6873506	555482	6873368

Results				
Species	Trapline			
	1	2	3	4
15/12/2018				
Planigale maculata	Not detected	Not detected	Not detected	Not detected
Rattus rattus	1			
Mus musculus	5	1		1
16/12/2018				
Planigale maculata	Not detected	Not detected	Not detected	Not detected
Rattus rattus	1			
Mus musculus	6	5	4	1
17/12/2018				
Planigale maculata	Not detected	Not detected	Not detected	Not detected
Rattus rattus				
Mus musculus	2	2	3	1
18/12/2018				
Planigale maculata	Not detected	Not detected	Not detected	Not detected
Rattus rattus		1	1	
Mus musculus		5	1	1

Targeted survey - Coxen's Fig Parrot						

Fig tree observation

Date	Start	Finish	Survey Effort (hours)	Result - Target species	Recorder	Weather
15/12/2018	9:30 AM	11:30 AM	2.0	Not detected	Kyle Spiteri	Overcast, light wind
15/12/2018	5:00 PM	7:00 PM	2.0	Not detected	Kyle Spiteri	Overcast, medium wind
16/12/2018	8:30 AM	10:30 AM	2.0	Not detected	Kyle Spiteri	Light wind, overcast
16/12/2018	5:40 PM	7:40 PM	2.0	Not detected	Kyle Spiteri	Medium wind, drizzle
17/12/2018	8:15 AM	10:15 AM	2.0	Not detected	Kyle Spiteri	Overcast, drizzle
17/12/2018	5:45 PM	7:45 PM	2.0	Not detected	Kyle Spiteri	Warm, sunny
18/12/2018	8:30 AM	10:30 AM	2.0	Not detected	Kyle Spiteri	Overcast, light rain
18/12/2018	5:05 PM	7:00 PM	2.0	Not detected	Kyle Spiteri	

Diurnal bird survey

Date	Start	Finish	Survey Effort (hours)	Result - Target species	Recorder	Weather
15/12/2018	7:55 AM	8:25 AM	0.50	Not detected	Dr Damian Licari	Overcast, light wind
15/12/2018	6:30 PM	7:00 PM	0.50	Not detected	Dr Damian Licari	Overcast, light wind
16/12/2018	7:15 AM	8:00 AM	0.75	Not detected	Dr Damian Licari	Overcast, light wind
17/12/2018	7:20 AM	7:50 AM	0.50	Not detected	Dr Damian Licari	Overcast, drizzle
17/12/2018	6:35 PM	7:10 PM	0.50	Not detected	Dr Damian Licari	Overcast
18/12/2018	7:15 AM	7:45 AM	0.50	Not detected	Dr Damian Licari	Overcast, drizzle

Result - Non-target species

Scientific name	Common Name
Anthochaera chrysoptera	Little Wattlebird
Cacatua sanguinea	Little Corella
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo
Centropus phasianinus	Pheasant Coucal
Corvus orru	Torresian Crow
Coturnix ypsilophora	Brown Quail
Cracticus quoyi	Black Butcherbird
Cracticus tibicen	Australian Magpie
Dacelo novaeguineae	Laughing Kookaburra
Dicrurus bracteatus	Spangled Drongo
Elanus axillaris	Black-shouldered Kite
Entomyzon cyanotis	Blue-faced Honeyeater
Eolophus roseicapillus	Galah
Geopelia humeralis	Bar-shouldered Dove
Grallina cyanoleuca	Magpie-lark
Leucosarcia picata	Wonga Pigeon
Malurus cyaneus	Superb Fairy-wren
Manorina melanocephala	Noisy Miner
Meliphaga lewinii	Lewin's Honeyeater
Neochmia temporalis	Red-browed Finch
Oriolus sagittatus	Olive-backed Oriole
Philemon corniculatus	Noisy Friarbird
Psophodes olivaceus	Eastern Whipbird
Rhipidura leucophrys	Willie Wagtail
Sphecotheres vieilloti	Australasian Figbird
Strepera graculina	Pied Currawong
Sturnus tristis	Common Myna
Threskiornis molucca	Australian White Ibis
Threskiornis spinicollis	Straw-necked Ibis
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet
Trichoglossus haematodus	Rainbow Lorikeet
Vanellus miles	Masked Lapwing
Zosterops lateralis	Silvereye

Results 17/12/18					
Waypoint	**Easting**	**Northing**	**No. of specimens**	**Species**	**Notes**
067	555520	6873214	3	*Sphaerospira fraseri*	
068	555514	6873211	3	*Sphaerospira fraseri*	
069	555485	6873180	1	*Sphaerospira fraseri*	
070	555484	6873181	1	*Sphaerospira fraseri*	
071	555479	6873180	1	*Sphaerospira fraseri*	
073	555493	6873432	2	*Sphaerospira fraseri*	
074	555473	6873467	1	*Sphaerospira fraseri*	
075	555464	6873478	1	*Sphaerospira fraseri*	
077	555665	6873510	1	*Sphaerospira fraseri*	
079	555733	6873517	1	*Sphaerospira fraseri*	

Results 18/12/18					
Waypoint	**Easting**	**Northing**	**No. of specimens**	**Species**	**Notes**
086	555399	6873131	1	*Sphaerospira fraseri*	
087	555358	6873121	1	*Sphaerospira fraseri*	Dead snail shell

Opportunistic recording - Mitchell's Rainforest Snail					
Date	**Start time**	**Finish time**	**Survey effort (hours)**	**Observer**	**Weather**
19/11/2018				Damian Licari, David Milledge	Cool, dry
Snail Site	**Easting**	**Northing**	**No. of specimens**	**Species**	**Notes**
1	555884	6873796	1	*Thersites richmondiana*	Juvenile
2	555881	6873789	1	*Thersites richmondiana*	Sub-adult
3	555419	6873629	1	*Sphaerospira fraseri*	Adult
4	555882	6873775	1	*Thersites mitchellae*	Adult
5	555882	6873743	2	*Thersites mitchellae* *Sphaerospira fraseri*	Dead shells
6	555864	6873712	2	*Sphaerospira fraseri* *Rhinella marina*	Adult

Targeted Survey - Mitchell's Rainforest Snail (Dr Stephanie Clark - refer third party report in Appendix G)					
Date	**Start time**	**Finish time**	**Survey effort (hours)**	**Observer**	**Weather**
19/12/2018			10	Dr Stephanie Clark, Craig Faulkner	Warm and dry, very high relative humidity
20/12/2018			16	Dr Stephanie Clark, Dr David Robertson, Craig Faulkner	Warm and dry, very high relative humidity
Zone	**Longitude**	**Latitude**	**No. of specimens**	**Species**	**Notes**
1	153°34'12"E	28°15'32" S	4	*Thersites mitchellae*	1x adult, 3x dead shells

Targeted survey - Eastern pygmy possum, Pale-headed snake, Grey-headed flying fox, Koala					
Date	**Start**	**Finish**	**Survey Effort (hours)**	**Recorder**	**Weather**
15/12/2018	8:30 PM	9:30 PM	2.0	Dr. Damian Licari, Kyle Spiteri	Overcast, light wind
17/12/2018	8:15 PM	9:30 PM	2.5	Dr. Damian Licari, Kyle Spiteri	Overcast, drizzle

Results		
Species	**15/12/2018**	**17/12/2018**
Hoplocephalus bitorquatus	Not detected	Not detected
Cercartetus nanus	Not detected	Not detected
Pteropus poliocephalus	Not detected	Not detected
Phascolarctos cinereus	Not detected	Not detected
Vulpes vulpes	2	
Pteropus alecto		1

Targeted survey for *Thersites mitchellae* (Cox, 1864) (Mitchell's Rainforest Snail) at 771 Cudgen Rd, Cudgen, NSW, site for the proposed Tweed Valley Hospital

Prepared for Herbert Smith Freehills LLP

Stephanie A. Clark

9 January, 2019

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Phone 0426204240
Email: meridolum@ozemail.com.au
http://www.invertebrateidentification.com/

Introduction

The author was engaged by Herbert Smith Freehills LLP to conduct a targeted survey for the New South Wales endemic land snail *Thersites mitchellae* (Mitchell's Rainforest Snail) at 771 Cudgen Rd, Cudgen, N.S.W, the proposed site for the construction of Tweed Valley Hospital (Figure 1). The purpose of the survey was twofold:

- to determine the nature and extent of habitat and potential habitat for the species on the subject site, particularly within corridors of regenerating rainforest that form narrow strips across the proposed development area (Figure 1);
- to consider whether development of the subject site as a hospital would have a significant impact on the species.

Mitchell's Rainforest Snail is currently listed as critically endangered under the Commonwealth's Environment Protection and Biodiversity Conservation Act, 1999 and as endangered under the New South Wales Biodiversity Conservation Act, 2016.

Previous surveys undertaken both on the site and lands adjoining the development site had found evidence for *Thersites mitchellae* along the northern boundary of the site but in vegetation that is being retained. These are shown as vegetation zones 1, 2 and 3 on Figure 1.

I have relevant qualifications and experience to conduct the survey, as set out in my CV attached at the end of this report.

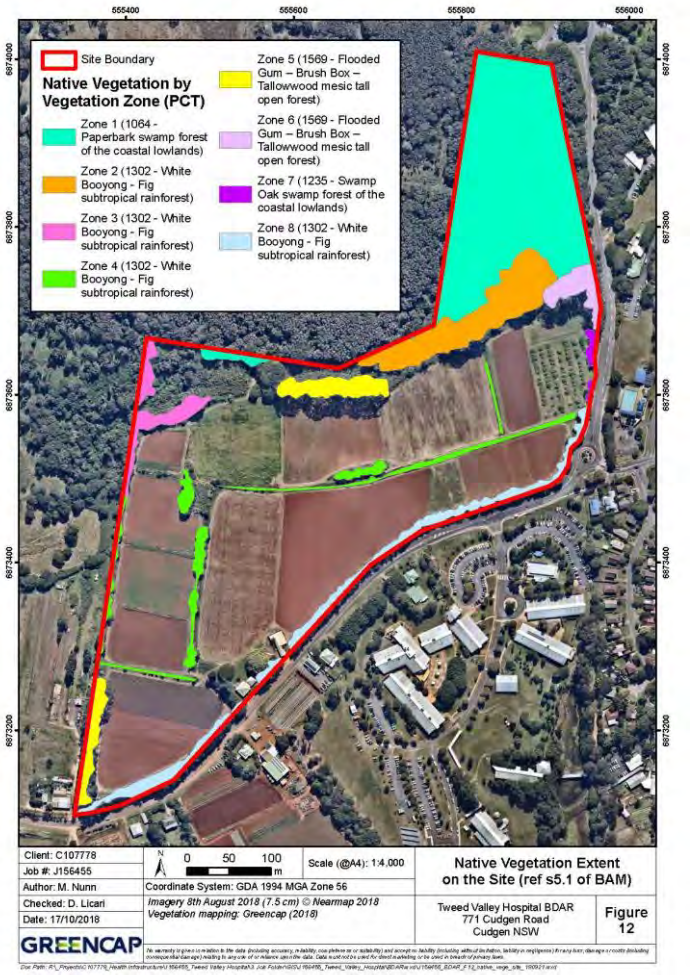

Figure 1. Site map showing the different vegetation zones.

Methods

The author examined draft reports outlining the proposed development of the subject land as the new Tweed Hospital. It was noted that development was proposed in the form of an early works program (various drainage and water management measures) (GeoLink, 2018a), followed by the construction of the hospital itself (GeoLink, 2018b).

The author and two colleagues (Dr David Robertson and Craig Faulkner) visited the site on 19-20th December, 2018, during which conditions appeared suitable to conduct surveys for terrestrial snails. The conditions were warm and dry with relative humidity very high, while only a small amount of rainfall had been recorded at the site in the previous two weeks.

Surveys for snails were conducted both during the day and at night. During the day, logs, rocks and other debris on the ground were turned and the leaf litter was raked. Snails actively crawling on the ground, on logs, rocks and the leaf litter etc, were searched for at night by spotlight (see Table 1 for search effort).

Efforts were concentrated in vegetation Zones 4 and 8 (see Figure 1) to determine if individuals of *Thersites mitchellae* might be present and or that these zones might provide suitable habitat for the species. In addition, the edges of Zones 2, 3 and 5 were searched using spotlights during the night.

The area zoned as Zone 1 in Figure 1, was briefly searched on 20th December, 2018. However, at the time of the site visit it was indicated that this area was no longer included as part of the development site. Given that there are known records for *Thersites mitchellae* (Bionet database searched, 7 December, 2018) both to the east and west of this area and that suitable habitat was present, it was thought highly likely that the species might be present.

Name	19 December	20 December
Dr Stephanie Clark	5 hours	6 hours
Craig Faulkner	5 hours	5 hours
Dr David Robertson		5 hours
Total	10 hours	16 hours

Table 1. Search effort in hours includes both day and night search effort.

Results

No evidence for *Thersites mitchellae* was found within Zones 4 and 8 nor along the edges of Zones 2, 3 and 5.

Land snails were found during the survey period. Three other species of snail were located in Zones 2-5 and 8:

- the non-listed native snails *Sphaerospira fraseri* (Griffith & Pidgeon, 1833) and *Terrycarlessia turbinata* Stanisic in Stanisic *et. al*., 2010, and
- the introduced snail *Bradybaena similaris* (Férussac, 1821).

Sphaerospira fraseri was the most abundant species recorded with more than 40 living individuals observed crawling on both nights, while *Terrycarlessia turbinata* was the least abundant with only four individuals being observed.

Thersites mitchellae was found in the northern extremity of Zone 1, within paperbark forest (Figure 1). The finds comprised one living individual and three dead shells of *Thersites mitchellae*. The habitat in which they were found is part of a large relatively unfragmented area of swamp forest with a moist understorey and a humid internal microclimate.

Discussion

The proposed development area has been extensively cleared and the remaining corridors of rainforest regeneration occur on well drained land that is relatively dry. They are not suitable habitat for *Thersites mitchellae:*

- The vegetation present in Zone 8 in not suitable habitat for *Thersites mitchellae*, as it is dominated by a line of large pines and otherwise very xeric with very few rainforest plants present along the length of the entire zone.
- The vegetation present in Zone 4 is also not considered suitable habitat for *Thersites mitchellae*, although a number of rainforest plants are present, there is still a high proportion of exotic species

present, the patches are generally relatively narrow and completely surrounded by cleared fields, resulting in the patches being susceptible to drying due to increased exposure to wind blowing across open the fields.

Swamp forest to the north of the site (Zone 1) does support a population of the snail. Similarly, Zones 2 and 3 appear to provide suitable habitat for *Thersites mitchellae*, but due to the fairly dry conditions during the site visit no evidence for the species was observed over the survey period.

It was observed that the existing cleared farmland is on hillsides that drain in unrestricted fashion into the larger blocks of forest and swamp forest on the northern portion of the subject land. The author believes that runoff from farmland may have impacted habitat values for the snail historically. Based upon the early works proposed for the site, and assuming best practice future stormwater management would be implemented for the hospital site, the author believes that it is likely that the future management of runoff may be beneficial to the existing areas of snail habitat to the north of the construction site.

Clearance of the strips of rainforest from the proposed development area (Zones 4 and 8) would not clear or otherwise significantly impact *Thersites mitchellae* habitat. No significant impact is likely upon the species from either the proposed early works program, or the main development proposal for the site.

References

GeoLink (2018a) Preliminary Works – Proposed Tweed Valley Hospital Site: Assessment of Review of Environmental Factors. Prepared by GeoLink for Health Infrastructure

GeoLink (2018b) Environmental Impact Statement: New Tweed Valley Hospital (Concept Proposal and Stage 1 Works). Prepared by GeoLink for Health Infrastructure

CURRICULUM VITAE OF STEPHANIE CLARK

PERSONAL

Business address	Faulconbridge, NSW 2776
Mobile	0426 204 240
E-mail:	meridolum@ozemail.com.au
Citizenship	Australian and American

EDUCATION

Ph.D., 2005. University of Western Sydney, New South Wales, Australia. Taxonomy and conservation.
M.Sc., 1998. Macquarie University, New South Wales, Australia. Taxonomy and genetics.
B.App.Sc., 1990. University of Technology, Sydney, New South Wales, Australia. Major biochemistry.

ACCREDITATIONS ETC

I am the first person to be listed as a Biodiversity Expert under Section 6.5.2.4 of the BAM, under the Biodiversity Conservation Act, 2017 for the snails *Meridolum corneovirens* and *Pommerhelix duralensis* as 16 May 2018.

PROFESSIONAL EXPERIENCE

Current and/or completed:

1997 - present. Consultant work (Invertebrate Identification Australasia - Owner) for various Australian and United States councils, government agencies (State, Commonwealth and Federal), environmental consultancies, mining companies and developers on short and medium term projects dealing mostly with molluscs and insects (particularly endangered species assessments).

Oct 2017 - Completed Biodiversity Assessment Method (BAM) course.

Aug 2017 – Sept 2017. Conduct one day snail identification workshops for the Department of Agriculture & Water Resources, biosecurity biomonitoring sections in Sydney, Melbourne and Perth.

Sept 2016 - Mar 2017. Identified almost 4000 lots of North American land and freshwater molluscs for the Field Museum of Natural History, Chicago, IL.

July 2016 – Dec 2016. Formally describe the US federally endangered freshwater snail, the Banbury Lanx for the Boise Office of the US Fish and Wildlife Service.

Feb 2015 – Mar 2016. Preparing a list of all the names, synonyms and combinations applied to the non-marine molluscs of North America, for the Field Museum of Natural History, Chicago, IL.

Oct 2014 – Feb 2016. Prepare a status report for the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) on the Shortface Lanx (*Fisherola nuttallii*) in Canada.

Jan 2013. Conducted a one day workshop on the identification of the endangered Cumberland Land Snail (*Meridolum corneovirens*) for the Ecological Consultants Association of NSW, Mount Annan, NSW, Australia.

June 2011 – present. Contracted with Deixis Consultants to write a Field Guide to the freshwater Molluscs of the Pit-Sacramento Rivers, California by the Cantara Trustee Council Grant Program.

Jan 2010 – Aug 2011. Co-founder and Executive Director, EKOsystems Services, LLP, Chicago, IL.

GRANTS

Clark, S.A. and Harris, P. State of Alabama Department of Conservation and Natural Resources - Distribution, life history, conservation and systematics of Alabama's Pebblesnails. Oct 2004 - Sept 2006. $26,930.

Clark, S.A. Hawkesbury Postgraduate Research Award - PhD, University of Western Sydney. Jan 2000 - Oct. 2002. $47,250.

Ponder, W.F. and Clark, S.A. Australian Biological Resources Study - Interactive CD-Rom guide and key to the freshwater Mollusca of Australia. Jan 1999 - Dec 2001. $90,000.

PROFESSIONAL SOCIETIES

American Malacological Society
Conchological Society of Great Britain and Ireland
Malacological Society of Australasia
The Ecological Consultants Association of New South Wales
Malacological Society of London
Royal Zoological Society of New South Wales
Freshwater Mollusc Conservation Society

Member of the IUCN SSC Mollusc Specialist Group.

RESEARCH INTERESTS

Systematics, population and conservation genetics of invertebrates, particularly terrestrial and freshwater molluscs.

EXPERIENCE

I have over 30 years experience in the collection, identification and taxonomy of marine, estuarine, freshwater and terrestrial molluscs in 16 countries and 40 US states. I have over 12 years experience using allozyme electrophoresis to study speciation and population genetics particularly of molluscs but also some work with reptiles and spiders and at least 5 years experience analysing DNA data. I have about 6 years experience preparing material for and using a scanning electron microscope and have dissected individuals from several hundred populations of freshwater and terrestrial molluscs.

LEGAL EXPERIENCE

I have served as an expert witness for the Land and Environment Court of New South Wales on six occasions since 1997 and have provided expert testimony for several other cases.

PROFESSIONAL ACTIVITIES

Research Associate at the Field Museum of Natural History, Chicago, Illinois, June, 2010 to present.

Vice President of the Chicago Shell Club, Chicago, Illinois, May, 2010 to May, 2016.

Courtesy Postdoctoral Researcher, Division of Malacology at the Florida Museum of Natural History, Gainesville, Florida, September, 2009 to 2016.

Invited participant at the IUCN Red List workshop assessing the Red List status of the world's freshwater molluscs, organised jointly by the Zoological Society of London, the Encyclopedia of Life (EOL), International Union for Conservation of Nature (IUCN), and the IUCN SSC Mollusc Specialist Group. Held in London, United Kingdom, February, 2010.

Served on the Status Review Panel for the federally endangered Idaho Springsnail (*Pyrgulopsis robusta*), in Boise, Idaho, for the United States Fish and Wildlife Service, Western Region, October, 2005.

TELEVISION

Short interview about my PhD project on the endangered endemic Sydney land snail *Meridolum corneovirens*, aired on 'Totally Wild' (a children's educational program on wildlife and the environment), Australia wide, 7 May 2002.

Short interview regarding the endangered endemic Sydney land snail *Meridolum corneovirens* and how the Olympic Coordinating Authority (OCA) has helped in its conservation, aired on 'A Current Affairs' (a prime time news and current affairs program) Australia wide on the 15 September, 1998.

RADIO

Short interview with Brian Bury, 4BC, Brisbane, about Australian native snail diversity aired Nov. 2002.

NEWSPAPER/INTERNET

Several interviews about molluscs, endangered species and rediscovering a species previously thought to be extinct, with national, local and internet media outlets, both in Australia and the United States since 2002.

Some recent examples:
ABC News: When Birds Overshadow Snails -- And Why That's a Problem
http://abcnews.go.com/Technology/story?id=734467&page=1

http://www.cofc.edu/~fwgna/archive/9May05.html

PUBLICATIONS

Keenan, S.W., Audrey T. Paterson, A.T., Niemiller, M.L., Slay, M.E., Clark, S.A. and Engel, A.S. 2017. Observations of the first stygobiont snail (Hydrobiidae, *Fontigens* sp.) in Tennessee. *Proceedings of the 17th International Congress of Speleology* **2017**:91-94.

Campbell, D.C., Clark, S.A. and Lydeard, C. 2017. Phylogenetic analysis of the Lancinae (Gastropoda, Lymnaeidae) with a description of the U.S. federally endangered Banbury Springs lanx. *ZooKeys* **663**:107-132.

Ponder, W.F., Hallan, A., Shea, M. and Clark, S.A. 2016. Australian Freshwater Molluscs. The snails and bivalves of Australian inland waters. Interactive key http://keys.lucidcentral.org/keys/v3/freshwater_molluscs/

Johannes, E.J. and Clark, S.A. 2016. Freshwater mollusc declines, local extinctions and introductions in five northern California streams. *Tentacle* **24**:22-25.

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Going Further in Managing Risk

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11 June 2019

To Jacqueline Hawkins,

Re: Rock wall tunnel and the Biodiversity Development Assessment Report (BDAR)

On 2 May 2019 Greencap was notified of a previously unobserved man-made tunnel-like structure located at Rock Wall 4. It was uncovered during clearing of exotic vegetation for the purpose of documenting cultural heritage values of rock walls located on the site of the new Tweed Valley Hospital. On 2 May I (Dr Damian Licari, Principal Consultant and Accredited Assessor) reviewed the photographs taken at the time of the clearing works and determined that this structure may provide potential habitat for cave-dwelling microbat species and that consequently this may have implications for credit offset requirements for the approved Stage 1 BDAR.

On 3 May Christina Maloney (Senior Environmental Consultant) and I inspected the structure to determine the likelihood of the structure being suitable roosting and/or breeding habitat for cave-dwelling microbat species. Based on a visual inspection using a spotlight and photographs, I determined that it was unlikely that the tunnel was used as roosting and/or breeding habitat by microbats on the basis that:

a) visual inspection found no evidence of current presence (i.e. roosting animals) nor evidence of past presence of microbats (i.e. scats/guano); and
b) prior to the recent cultural heritage documentation, the tunnel was overgrown in dense exotic vegetation (primarily Sicklethorn *Asparagus falcatus*) which blocked microbat flyway access the tunnel.

Following this inspection I sought an expert opinion from a bat specialist (David Milledge, Landmark Ecological Services). Mr Milledge inspected the structure on Wednesday 29 May and prepared a report that concurred with my assessment of the structure (Attachment 1).

The identification and assessment of the structure is applicable to the Stage 1 BDAR as it will be removed as part of the Stage 1 works. The presence of the structure should be documented because the Stage 1 BDAR currently states "*Field assessment did not locate any caves, tunnels, mines or other structures known or suspected to be used by the species for breeding are located on the Site*" to justify exclusion of the above species from the assessment (Stage 1 BDAR Greencap 2019; Table 6). The Stage 1 BDAR and SSD application was already lodged at the time the structure was discovered. The finding is considered unforeseeable prior to the clearance of the dense vegetation, hence the assessment has occurred post-application.

The Stage 1 BDAR should be amended with the above findings to correctly note the presence of potential microbat habitat. In accordance with published guidelines[1], two candidate microbat species identified by the BAM Calculator (i.e. Little bentwing-bat *Miniopterus australis* and Eastern bentwing-bat *Miniopterus schreibersii oceanensis*, also 'potential' serious and irreversible impact [SAII] species) would remain excluded from the Stage 1 BDAR assessment. This is based on my assessment that microhabitats on which the species depend are sufficiently degraded such that the species are unlikely to utilise the subject land (i.e. dense exotic vegetation obstructed flyway access to the structure). Consequently, there would be no change in credit offset requirement and I do not foresee a negative impact on the outcome of the Stage 1 BDAR.

As a matter of professional diligence as an Accredited Assessor and to allow NSW Health Infrastructure to manage any risks of non-compliance with the legislation, the Stage 1 BDAR needs to be updated accordingly. However, as the timing for updating the Stage 1 BDAR is undesirable given the application is currently being determined I recommend as an alternative that OEH is informed of the above findings and the agency's advice on their preferred course of action is sought given that the outcome presents no negative impact on the Stage 1 BDAR.

[1] Office of Environment and Heritage (2018),*'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method.*

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Greencap is keen to work with NSW Health Infrastructure in reaching the outcome with least risk to project cost and schedule and can raise this issue with OEH together with TSA or act on TSA's behalf.

We look forward to your response.

Regards,

Dr Damian Licari
Principal Consultant - Environment | Greencap

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Attachment 1: Assessment of Tunnel-Like Structure

LANDMARK
Ecological Services Pty Ltd
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DAVID MILLEDGE | DIRECTOR
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4 June 2019

Report on an inspection of a tunnel formed by an old boiler-like structure built into a stone wall at the site of the new Tweed Hospital and its potential as a roosting site for threatened hollow-dependent microbats

On 29 May 2019 I inspected a tunnel formed by an old boiler-like structure built into a dry-stone wall at the site of the new Tweed Hospital, 771 Cudgen Road, Cudgen (**Photos 1, 2** and **3**) in the company of Christina Maloney of Greencap. GPS co-ordinates for the location of the tunnel are (GDA94) Easting 555680, Northing 6873508.

The dimensions of the tunnel were approximately 1.5 m in width, 1.0 m in height and 2.5 m in length. The entrance of the tunnel was boarded up with plywood when I arrived but this was removed to allow an inspection and photographs to be taken. The end wall of the tunnel was noted to be constructed of loosely wedged stones and the floor was relatively firmly-packed soil (**Photos 1** and **2**).

I inspected the walls including the end wall and the floor of the tunnel closely but could find no indication of its past use as a roost site by species of microchiropteran bats (microbats), particularly threatened (*Biodiversity Conservation* (*BC*) *Act 2016*) microbats.

Human made structures and rocks/stones are prescribed impacts identified under the *BC Regulation* (clause 6.1) and this boiler-like structure in the stone wall was considered to have represented potential roosting habitat for threatened cave-dwelling microbat species prior to the time of its location in early May 2019.

My inspection did reveal a series of droppings (scats) scattered on the floor of the tunnel that appeared relatively fresh, but these appeared to be of the introduced Black Rat *Rattus rattus* based on their size, shape and texture.

When the tunnel was initially located it was screened across its entrance by a dense growth of Sicklethorn *Asparagus falcatus* (C. Maloney pers. comm.), an exotic scrambler that formed an impenetrable barrier to its entry (**Photo 4**). This vegetation was cleared from the tunnel entrance in early May 2019 (C. Maloney pers. comm.).

My opinion is that with the Sicklethorn barrier in place, the tunnel would not have provided a suitable temporary or breeding roost site for either of the two cave-dwelling microbat species that have been identified as Biodiversity Assessment Methodology (BAM) Candidate (breeding) credit species in the Biodiversity Development Assessment Report (BDAR) for the new Tweed Hospital site. These comprise the Vulnerable (*BC Act 2016*) Little Bent-winged Bat *Miniopterus australis* and Eastern Bent-winged Bat *M. schreibersii* and in my experience both species require a relatively clear entrance or flyway to a roost site. In addition, it is unlikely that either species would have used the tunnel for roosting due to its restricted dimensions as they typically use caves or artificial structures that extend substantially further underground than the 2.5 m length of the subject tunnel.

Two additional threatened (*BC Act 2016*) cave-dwelling microbat species that may occur in the general area of the new Tweed Hospital site, the Large-eared Pied Bat *Chalinolobus dwyeri* and Eastern Cave Bat *Vespadelus troughtoni* could potentially roost in a structure with the dimensions of the subject tunnel. However, neither of these species are likely to forage in the habitats present in the site and would also have been unlikely to use the tunnel for roosting because of the dense screening of the entrance by Sicklethorn. In addition, neither of these threatened species were identified as candidate or predicted species by the BAM Calculator in the BDAR assessment.

Photo 1 **The tunnel formed by the old boiler-like structure built into the stone wall at the site of the new Tweed Hospital showing dimensions and hardened soil forming the floor Photo D. Milledge**

Photo 2 **The end wall of the tunnel formed by loosely wedged stones and the area of the floor where scattered droppings, probably from the introduced Black Rat *Rattus rattus*, were found Photo D. Milledge**

Photo 3 **The tunnel entrance in the dry-stone wall that was previously covered by a dense growth of Sicklethorn *Asparagus falcatus* Photo D. Milledge**

Photo 4 **The dense growth of Sicklethorn *Asparagus falcatus* that covered the entrance to the tunnel in the stone wall, taken in early April 2019 before it was cleared to reveal the tunnel's existence** **Photo C. Maloney**

David Milledge

Director

APPENDIX H. HERBARIUM CORRESPONDENCE

The Royal
BOTANIC GARDENS
& Domain Trust

National Herbarium of New South Wales

Gina MINATEL
Greencap
Level 8/133 Mary Street
brisbane City, QUEENSLAND 4000
AUSTRALIA

Enquiry No: 20733
Botanical.Is@rbgsyd.nsw.gov.au
Fax No: (02) 9251 1952
Ph. No: (02) 9231 8111
Date: 11 September 2018

Dear Gina MINATEL,

Thank you for your enquiry of 28-Aug-18. We are happy to provide the following information:

Dear Gina,
Dr Peter Weston and I spent yesterday looking through our Macadamia specimens and those of yours and another enquirer. I understand you no longer require this information but thought you might be interested in the results anyway. There is of course no charge for this enquiry. We also examined aerial maps and species distribution maps to determine context for your specimens. The rural setting and nearby plantations influenced our thinking.
075 *Macadamia integrifolia* <-> *tetraphylla* det P.H. Weston & B.M. Wiecek 10 Sep 2018, leaves almost entire but too long and large for *M. tetraphylla*, leaves in 2s,3s, and 4s (mostly 4s as in *tetraphylla*)
074 *Macadamia integrifolia* <-> *tetraphylla* det P.H. Weston & B.M. Wiecek 10 Sep 2018, leaves in 3s, more teeth than 075 but far too large for *tetraphylla*
058 *Macadamia integrifolia* <-> *tetraphylla* det P.H. Weston & B.M. Wiecek 10 Sep 2018, leaves in 3s, more teeth than 075 but far too large for *tetraphylla*

Thank you for your enquiry.

Yours sincerely

Barbara Wiecek
Identification Botanist
Botanical Information Service

PlantNET

Go to our online Botanical Information Services at plantnet.rbgsyd.nsw.gov.au to find out more about plants of New South Wales

NSW GOVERNMENT | Office of Environment & Heritage

APPENDIX I. INDIRECT IMPACT ASSESSMENT

Appendix I Indirect Impacts and Mitigation Measures

Aspect	Project phase	Potential Impact	Mitigation	Risk before Mitigation	Risk After Mitigation
Noise	Construction	Noise during construction due to construction works and construction traffic. Potential disruption of threatened species or reduced viability of adjacent habitat.	• Noise during construction will be mitigated by applying appropriate safeguards and management measures before works commence including daily timing of construction activities and such as restricting works to approved construction hours in accordance with the Noise Policy for Industry (NSW EPA 2017) and ~~,~~ Interim Construction Noise Guidelines (DECC 2009) ~~and the approved CNVMP~~. Furthermore, construction will be restricted to the southern portion of the Site where the project footprint is at least 67 m from the remnant native vegetation. This provides a natural buffer zone to dissipate noise and vibration impacts. • Noise levels during construction will be ~~delivered~~ managed in accordance with ~~the~~ an approved Stage 2 Construction Noise & Vibration Management Sub-plan (CNVMP) and by implementing the control measures listed in the Noise and Vibration Impact Assessment (JHA 2019).~~CEMP Construction Noise and Vibration Management Sub-Plan.~~ • • The Noise and Vibration Impact Assessment (JHA 2019) identified noise and vibration sensitive receivers that will potentially be impacted by the operation of the Project, established relevant noise level criteria, carried out noise assessments, determined whether the relevant criteria can be achieved and provided recommendations. Based on the results of the preliminary assessment, the noise associated with the normal construction works is not expected to ~~meet~~exceed the noise limits for standard hours & out-of-hours works in accordance with the Interim Construction Noise Guideline (DECC 2009). Furthermore, the results of the external mechanical plant noise emission assessment indicated that the noise level criteria will be met during operations and traffic generated as a result of the proposed hospital development is not expected to have an adverse noise impact on the surrounding roads (JHA 2019). • Noise and vibration monitors were established during Stage 1 in three different locations on site, covering the areas that are most susceptible to be affected. The sensors will be maintained throughout the duration of construction works. The sensors will trigger a warning (sent to the nominated recipient) when the maximum allowed levels are exceeded (LLB 2019).	Low	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before Mitigation	Risk After Mitigation
			• Additional assessments may be conducted in response to changes in the work environment, the timing of which will be determined in consultation between the site management, Site Safety Committee and the Principal (LLB 2019). ~~Noise and Vibration Impact Assessments for the Project should consider acoustic and vibration ecological sensitive receivers. Objectives of the Draft Noise and Vibration Impact Assessment (JHA 2019) are to identify noise and vibration sensitive receivers that will potentially be impacted by the operation of the Project, establish the appropriate noise levels and vibration criteria, carry out noise assessments, determine whether the relevant criteria can be achieved and provide recommendations for Construction Noise and Vibration Planning.~~		
	Operation	Noise during operations including traffic. Potential disruption of threatened species or reduced viability of adjacent habitat.	• Noise levels during operations ~~would~~ will be ~~delivered~~ managed in accordance with an approved Operational Environmental Management Plan (OEMP) that details safeguards and management measures in accordance with the *POEO (Noise Control) Regulation 2017* or any other relevant Tweed Shire Council noise regulation. • Potential noise impacts on noise sensitive receivers for helicopter operations are addressed within the Airservices Australia Principles and Procedures for minimizing the impact of aircraft noise fly Neighbourly Guide (JHA 2019).	Low	Very low
Vibration	Construction	Vibration during construction due to construction works and construction traffic. Potential disruption of threatened species or reduced viability of adjacent habitat.	~~•~~ Vibration levels during construction will be managed in accordance with an approved Stage 2 Construction Noise & Vibration Management Sub-plan (CNVMP)~~delivered in accordance with the approved CEMP Construction Noise and Vibration Management Sub-Plan.~~ • . • Noise and vibration monitors were established during Stage 1 in three different locations on site, covering the areas that are most susceptible to be affected. The sensors will be maintained throughout the duration of construction works. The sensors will trigger a warning (sent to the nominated recipient) when the maximum allowed levels are exceeded (LLB 2019). ~~•~~ ~~Noise and Vibration Impact Assessments for the Project should consider acoustic and vibration ecological sensitive receivers. Objectives of the Draft Noise and Vibration Impact Assessment (JHA 2019) are to identify noise and vibration sensitive receivers that will potentially be impacted by the operation~~	Low	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before Mitigation	Risk After Mitigation
			~~of the Project, establish the appropriate noise levels and vibration criteria, carry out noise assessments, determine whether the relevant criteria can be achieved and provide recommendations for Construction Noise and Vibration Planning.~~ • Vibration during construction will be mitigated by applying appropriate safeguards and management measures before works commence including daily timing of construction activities and such as avoiding night works as much as possible. • • Construction will be restricted to the southern portion of the Site where the project footprint is at least 67 m (the width of the APZ for bushfire protection) from the remnant native vegetation.		
	Operation	Vibration during operations including traffic. Potential disruption of threatened species or reduced viability of adjacent habitat.	• Vibration levels (if any) during operations would be managed in accordance with an approved OEMP that details safeguards and management measures in accordance with relevant standards and guidelines.	Low	Very low
Light spill	Construction	Light spill during construction due to construction lighting and construction traffic. Potential disruption of threatened species or reduced viability of adjacent habitat.	• Light sensitive species are presumed unlikely to be present at the Site. • Construction will be restricted to the southern portion of the Site where the Project footprint is at least 67 m (the width of the APZ for bushfire protection) from the remnant native vegetation. This provides a natural buffer zone to dissipate light spill impacts. • All construction works and associated activities would be delivered in compliance with AS4282 and AS1158. As per the CEMP (LLB 2019); the lighting designer will have the appropriate competence in the fields of illuminating engineering and environmental design. • Mitigation measures to reduce the impact of potential disruption to threatened wildlife species or reduced viability of adjacent habitat from light spill during the construction of the Project include a range of measures as detailed in the	Low	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before Mitigation	Risk After Mitigation
			CEMP and Stage 2 BMP, and include measures to avoid impacts on ecologically and environmentally sensitive areas.		
	Operation	Light spill during operations. Potential disruption of threatened species or reduced viability of adjacent habitat.	• The Site does not contain habitat for threatened species that are drawn to light (i.e. turtles) that could be adversely impacted by light spill. • The development will be located at least 67m (the width of the APZ) from vegetation (Zones 1,2,3). Provision of lighting would be delivered in accordance with the approved CEMP and any relevant standards and guidelines, in particular local hospitals. • The lighting design will include measures to avoid impacts on ecologically and environmentally sensitive areas. Light spill will be minimised during the construction and operations of the Project by incorporating a range of external lighting design approaches as per the External Lighting Strategy Report (LCI 2019) and Stage 2 BMP.	Low	Very low
Visual Amenity	Construction	Rubbish and waste retained onsite attracting native fauna.	• Activities on the Site will be managed in accordance with the approved CEMP and Construction Waste Management Sub-Plan (CWMSP); and designed to limit the amount of rubbish and waste onsite through good housekeeping practices.	Low	Very low
	Operation	Rubbish and waste retained onsite attracting native fauna.	• Activities on the Site will be managed in accordance with ~~the~~ an approved CEMP and Construction Waste Management Sub-Plan (CWMSP); and designed to limit the amount of rubbish and waste onsite through good housekeeping practices.	Low	Very low
Dust	Construction	Inadvertent impacts of dust deposition on native vegetation or threatened species. Potential disruption of threatened species or reduced viability of adj acent habitat.	• Dust levels during ~~operations~~ construction will be managed in accordance with ~~the~~ an approved CEMP Construction Air Quality Management and Dust Management Sub-Plan that details safeguards and management measures in accordance with relevant guidelines for construction sites. Site specific controls have been identified in this Sub-plan to prevent or minimise the impacts of construction related air emissions on the environment and community (LLB 2019), ~~,~~ including: ~~○ Air quality monitoring~~ ○ Planning of construction activities to meet dust management requirements	Low	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before Mitigation	Risk After Mitigation
			○ Dust suppression techniques ○ Stockpile management ○ Road management and sealing ○ Maximum speed limits ○ Designation of trafficable areas ○ Minimising handling of soil/rock materials ○ Covering of loads ○ Air quality monitoring will be undertaken where required, as per project approval, and the effectiveness of management controls periodically reviewed • The details of all measures are discussed in further detail in the Stage 2 BMP.		
	Operation	Inadvertent impacts of dust deposition on native vegetation or threatened species. Potential disruption of threatened species or reduced viability of adjacent habitat.	• It is expected that dust generation during operations will be negligible once construction activities cease, and air quality/dust management will occur in accordance with *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA) and *Guidelines for development adjoining land and water managed by DECCW* (OEH, 2013).	Low	Very low
Retained native vegetation	Construction	Damage or removal of retained native vegetation. Unplanned loss of habitat.	• All works and associated activities are to be delivered in accordance with the approved CEMP and sub plans, the VMP in the Stage 1 and Stage 2 BMPs, and the Landscape Masterplan Report (Turf 2019). • All existing trees and areas of native vegetation not identified for removal on approved plans of the proposed development shall be protected from damage during works. • The measures are detailed in the VMP in Stage 1 and Stage 2 BMPs, and include: ○ Maintain tree protection zone (TPZ) around retained native vegetation inside the temporary boundary fence, including the two high and moderate retention value *Ficus* sp. Trees and one *Cryptocarya foetida*. ○ Establish a TPZ at the Tweed Coast Road/Cudgen Road Intersection. ○ Maintain protective fencing and signage.	Low	Very low

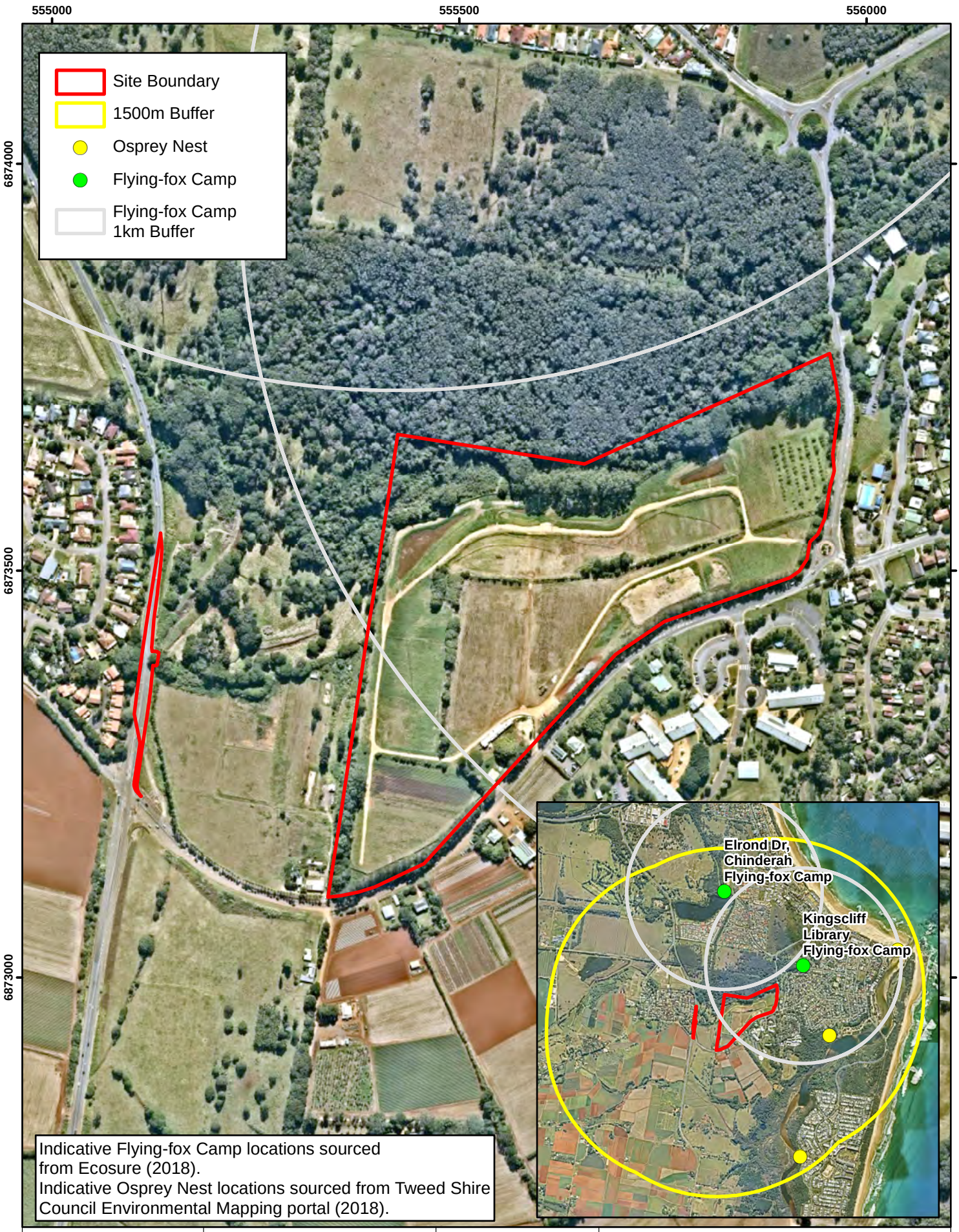
NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before Mitigation	Risk After Mitigation
			○ Vegetation management works within areas containing native vegetation must be undertaken by a suitably qualified and experienced bush regeneration contractors. ○ Suitably qualified and experienced arborists must be engaged to undertake vegetation clearing works. ○ Clearing vegetation as per approval at the Tweed Coast Road/Cudgen Road Intersection upgrade. ○ Translocation of threatened plant *Cryptocarya foetida.* ○ Ensuring contractor awareness. • Potential impacts on MRS are to be managed by: ○ management of vegetation in core MRS habitat to protect and increase the quality of habitat by improving key habitat requirements of well-developed leaf litter and intact canopy as detailed in the Stage 2 BMP. ○ Development of a scientific survey and management plan for the MRS at the Site by a specialist invertebrate consultant, Dr Stephanie Clark, including a baseline survey (conducted in May 2019), an ongoing repeatable monitoring program, and scheduled reporting		
	Operation	Damage or removal of retained native vegetation. Unplanned loss of habitat.	• Native vegetation management will continue to occur during operations as per the BMP and VMP sub-plan. • It is recommended in the Stage 2 BMP that Site Management enforce various policies including not permitting pets in areas of conservation. • Potential impacts on MRS are to be managed by: ○ management of vegetation in core MRS habitat to protect and increase the quality of habitat by improving key habitat requirements of well-developed leaf litter and intact canopy as detailed in the Stage 2 BMP. ○ Development of a scientific survey and management plan for the MRS at the Site by a specialist invertebrate consultant, Dr Stephanie Clark, including a baseline survey (conducted in May 2019), an ongoing repeatable monitoring program, and scheduled reporting	Low	Very Low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before Mitigation	Risk After Mitigation
Non-native vegetation	Construction	Introduction of weeds to the Site.	• In order to avoid the introduction or spread of weeds on the Site, weed hygiene practices will be implemented in accordance with the approved CEMP and sub plans, and the Stage 1 and Stage 2 BMPs. • Mitigation measures for weed control are detailed in the BMPs, and include: o Ongoing vehicle inspection and wash-down o Inspection and wash-down procedures o Topsoil management o Communication of biosecurity risk management to all personnel o Appropriate disposal of weed contaminated material o Weed control measures o Contractor awareness o *Salvinia molesta* aquatic weed infestation control in the wetland area o Decommissioning and infilling of the farm dam in the northwest of the Site • Potential impacts on MRS are to be managed by: o A black rat *Rattus rattus* control program to be implemented during construction of the Project. o Development of a scientific survey and management plan for the MRS at the Site by a specialist invertebrate consultant, Dr Stephanie Clark, including a baseline survey (conducted in May 2019), an ongoing repeatable monitoring program, and scheduled reporting	Low	Very low
	Operation	Introduction of weeds to the Site.	• Vegetation will continue to be managed during operations in accordance with the Stage 2 BMP VMP sub-plan.	Low	Very low
Bushfire / Changing Fire Regimes	Construction	Changes to existing fire regime and / or increased prevalence of fire.	• Bushfire impacts will be identified and managed through the Bushfire Hazard Assessment Report (GeoLINK 2019) impact assessment and associated management plans. • There will be minimal impact to retained native vegetation as most of this is outside the Asset Protection Zone (APZ). • The APZ will be separated into Inner (IPA) and Outer (OPA) zones. No retained vegetation is present within the IPA.	Low	Very low
	Operation			Low	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.



Client: C107778	N 0 80 160 m	Scale (@A4): 1:6,000	**Indicative Location of Flying Fox Camps and Osprey Nests**
Job #: J156455-13			
Author: D. Correa	Coordinate System: GDA 1994 MGA Zone 56		
Checked: C. Maloney	*Note: All data is approx only & subject to survey.*	Tweed Valley Hospital Stage 2 BDAR 771 Cudgen Road Cudgen NSW	**Figure I-1**
Date: 9/08/2019	*Imagery 15th July 2019 (1.2 m) © Nearmap 2019*		
GREENCAP			

No warranty is given in relation to the data (including accuracy, reliability, completeness or suitability) and accept no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of or reliance upon the data. Data must not be used for direct marketing or be used in breach of privacy laws.

Doc Path: R:_Projects\C107778_Health Infrastructure\J156455_Tweed Valley Hospital\3. Job Folder\GIS\J156455_13_TVHs2\BDARs2\mxd\J156455_13_BDARs2_zI01_flyingfoxes_ospreys_190809.mxd

APPENDIX J. PRESCRIBED IMPACT ASSESSMENT

Appendix J Prescribed Impacts and Mitigation Measures

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities.					
Hydrology	Construction	Sediment run-off during construction. Sediment basin discharge water quality	Management of water quality, water bodies and hydrological processes that sustain threatened species and TECs to be managed as per: • Water Quality Management Plan (WQMP) as per Section 4 of the Stage 2 BMP with detailed measures in Section 4, Table 11; • CEMP and associated CSWMSP; and • SWMP and ESCP. These measures include: • Location of development footprint to minimise interference with hydrological flows; • Stormwater management systems modelled in accordance with the locally appropriate standard the *Tweed Shire Council Development Design Specification - D7* (TSC 2016) and guidelines for development adjoining land and water managed by DECCW (OEH 2013) to minimise the risk of erosion and sediment-laden stormwater into the receiving catchment and wetland; • Erosion and sediment control (ESC) design is in accordance with the guidelines in Best Practice Erosion and Sediment Control (IECA 2008), the *NSW Managing Urban Stormwater "Blue Book"* (Landcom 2004); • Installation of four adequately sized sediment basins with a total capacity of 7,562 m^3 volume were constructed as part of Preliminary Works package to capture flows (Bonacci 2019); • Prior to a controlled discharge event, the four sediment basins will be sampled at the discharge points (near the outlet) to ensure the quality of water released is consistent with the water quality objectives;	High	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
			• The sediment basins will be converted into bio-detention basins once the site excavation works and roads have been completed and all surfaces have been stabilised with appropriate ground cover (i.e. landscaping has commenced); • Protection of receiving catchment by providing diversion stormwater drainage lines that bypass the construction site; • Monitoring of the sediment basins for aquatic weeds; • Suitable plant selection for revegetation around the basins; • Selection of a flocculant for use in sediment basins that does not create a significant pH change but works effectively as gypsum to be used to mitigate risks to pH dependent threatened species within the wetland area (i.e. Wallum froglet *Crinia tinnula* and Olonburra frog *Litoria olongburensi*), as detailed in the Stage 2 BMP; and • In accordance with section 9.4.2 of the BAM, the WQMP in the Stage 2 BMP includes measures to monitor water quality in the receiving environment (uncontrolled event-based and monthly). Water quality monitoring commenced in pre-construction and will be undertaken during periodically to detect changes during construction in receiving water quality resulting from the Project. Water quality results shall be compared against the adopted water quality guidelines as per the Stage 2 WQMP as well as monitoring for change (trends in increases or decreases) over time. Exceedances and/or any continuous changes in water quality will trigger investigation and adaptive management actions.		

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
	Operation	Changes in water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities	Management of water quality, water bodies and hydrological processes that sustain threatened species and TECs to be managed as per: • Water Quality Management Plan (WQMP) as per Section 4 of the Stage 2 BMP with detailed measures in Section 4, Table 11; and • SWMP and ESCP. These measures include: • A stormwater drainage system will be constructed to convey stormwater runoff from the buildings and associated, roads, carparks and landscape areas. It has been designed to mimic natural flows to minimise future impact to the endangered ecological community in the receiving wetland; • The storage volumes of the converted basins were designed to ensure that the combined post development discharge from the basins is no greater that the pre-development flow (there is no increase in the total site discharge rate in the 5-year and 100-year ARI storm events) (RBG 2019); • The stormwater management system for the Site uses Water Sensitive Urban Design Measures (WSUD) – installation of bio-retention basins to reduce nutrient levels of stormwater discharged from the site and incorporates swales, enviropods and the use of landscaped areas for filtering runoff. Ultimately the bulk of the stormwater will end up in a bio-detention basin where it will settle and discharge to the receiving waters in a controlled manner. The water quality strategy for the Site is outlined in the SWMP (RBG 2019); • Monitoring of the bio-detention basins for aquatic weeds; • Additionally, new plantings within rain gardens that both treat stormwater quality and contribute to providing a range of native habitat or 'moist corridors' across the site (Turf 2019); and	High	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
			• As described above, water quality monitoring commenced in pre-construction and will be undertaken periodically during operations. Water quality results shall be compared against the adopted water quality guidelines as per the Stage 2 WQMP. The surface water monitoring objectives for the Site during operations are to detect changes in receiving water quality resulting from the Project. An assessment of the potential ecological impact on the coastal wetlands to the north of the site as a result of any changes to hydrology (flow regimes) caused by the Project was undertaken by SMEC (2019). The assessment considered EECs, TECs, threatened species and the overall biophysical, hydrological and ecological integrity. The modelling conducted as part of the assessments predicts a mean total annual flow from site to increase by almost 50% from 90.6 ML/yr pre-development to 140 ML/yr post development. The potential impacts of these additional flows on the EECs identified on the Site, Mitchell's rainforest snail *Thersites mitchellae* (MRS) and two pH dependent threatened species (i.e. Wallum froglet *Crinia tinnula* and Olongburra frog *Litoria olongburensis*) were assessed by Jon Alexander, an ecologist and suitably qualified professional. In summary, the assessment found that the predicted minor increases in flow are unlikely to result in any apparent or significant impacts (SMEC 2019). It is a design requirement to achieve a reduction of peak 1% and 20% peak flows to below existing levels, and with minor basin modification the proposed stormwater management will achieve this. The impact of increased and more frequent flows on the wetland is assessed as minimal, however, to reduce the modelled higher frequency flows (more frequent than the 20% AEP), mitigation measures recommended by SMEC (2019) include additional assessment to be carried out to inform potential modification(s) in the basin outflow design, such as staging the basin outlets to reduce peak discharges		

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
			and by removing the proposed bio-basin lining and providing additional infiltration downstream of the basins.		
Hydrogeology	Construction	Changes in water quality, water bodies and hydrological processes that sustain threatened species and threatened	To avoid any impacts on groundwater, particularly during piling and excavation activities, all works and associated activities are to be delivered in accordance with an approved; • Water Quality Management Plan (WQMP) as per Section 4 of the Stage 2 BMP with detailed measures in Section 4, Table 11; • CEMP and associated CSWMSP and CWMSP; and • SWMP and ESCP.	Medium	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
		ecological communities	Mitigation measures include: • A spill prevention and response management plan, along with supporting documentation, will be produced as part of the Project's CEMP and their prescriptions will be implemented to minimise the risk of surface water or groundwater contamination; and • Other than what may be required for piling, subsurface excavations will be at a shallower depth than measured depth to groundwater on the Site. The proposed less intrusive method of pile construction using a continuous flight auger (CFA) or Bore Pile type is expected to remove the requirement to de-water from groundwater table during piling activities (Darren Chow, Lendlease Building Pty Ltd, pers. comm. 25 June 2019); • Whilst no site specific groundwater modelling data was available to the time of writing this report, the level that groundwater was encountered in test bores was upslope and therefore at a higher elevation than the wetlands. This suggests that there is potential for groundwater to influence the wetlands and provide some base flow. However, contaminated land investigations to date (Cavvanba 2019; Octief 2018) found localised, but no widespread ecological issues on the Site and that the Cudgen Creek off-site environmental receptor and associated creeks are unlikely to be exposed to the contamination pathway due to the distance from the source area and depth of the groundwater; and • The groundwater and intrusive soil investigation in July 2019 recommended a further groundwater monitoring round to investigate the exceedances of criteria for zinc and mercury; the presence of low-level detections of TRH; and to conduct analysis for OCPs with appropriate LORs in comparison to site criteria (Cavvanba 2019).		

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
	Operation	Change in ground water base flow to wetland and water bodies that sustain threatened species and threatened ecological communities.	To avoid any impacts on groundwater, all works and associated activities are to be delivered in accordance with an approved; • Water Quality Management Plan (WQMP) as per Section 4 of the Stage 2 BMP with detailed measures in Section 4, Table 11; and • SWMP and ESCP. Mitigation measures include: • Geotechnical investigations undertaken by Morrison Geotechnical (2018) identified that the water table is approximately at RL 11.0. The future building will not have finish floor levels below RL 11.0, therefore lowering the water table or dewatering will not be required. As the piles will typically be spaced 8.4 m apart and are not continuous, it is not anticipated that they will create a barrier to any shallow or perched groundwater flow that currently occurs within the Project footprint, minimising the potential for the development to impact groundwater contributions to base flow in the wetlands; • It is expected that any reduction of groundwater recharge due to the development footprint of the hospital would be mitigated through recharge that would occur through the proposed WSUD measures such as: rain gardens, swales, car park plantings to reduce impervious surfaces, managing stormwater and ground water recharge through landscaping; • It is recommended that the bioretention basins are modified to be unlined and that the outlet channels be extended along the contour with wide flow spreaders to connect to the wetland (1%AEP velocity < 1m/s) so that stormwater can infiltrate to the wetland rather than being contained in a lined basin (SMEC 2019); and • In accordance with section 9.4.2 of the BAM, a Biodiversity Management Plan has an adaptive management approach, and the water quality monitoring program will ensure alignment with any changes in Site activities and potential impact pathways and determine whether groundwater quality parameters are monitored.	Medium	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
Impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community					
Traffic	Construction	Vehicle strikes	To avoid any impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community, all works and associated activities are to be delivered in accordance with an approved; • Fauna Management Plan (FMP) as per Section 3 of the Stage 2 BMP with detailed measures in Table 8; and • CEMP and associated sub plans (CHMSP and CTPMSP). Mitigation measures include: • A suitably qualified and experienced fauna rescue person shall be present to supervise the clearing activities. A Fauna Management Procedure for vegetation and rock clearing activities on the Site is outlined in Section 3.7 of the Stage 2 FMP; • Traffic will be restricted to the southern portion of the Site where the Project footprint is which is approximately 67 m from the intact remnant native vegetation; • Construction traffic must maintain low vehicle speeds, with a20km/hr speed limit on internal roads and access ways (LLB 2019) and operators shall take care and be aware of any wildlife that may be in the area. Should wildlife enter the construction footprint, a suitably qualified fauna handler should be notified, and actions taken in accordance with the FMP; • Any injured native fauna detected shall be rescued and transferred to a local veterinarian for treatment and/or WIRES for rehabilitation. • Monitoring of species mortality and injuries. Should an increase in Project related fauna mortalities/injuries occur, this will trigger investigation and adaptive management actions. • Weed control measures will improve the function of the wildlife fence located adjacent to the koala habitat on the Site. This fence is a barrier	Low	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
			and will provide better protection for risk of vehicle strike to fauna trying to cross Turnock Street.		
	Operation	Vehicle strikes	To avoid any impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community, all works and associated activities are to be delivered in accordance with an approved Fauna Management Plan (FMP) as per Section 3 of the Stage 2 BMP with detailed measures in Table 8. Mitigation measures include: • During Stage 2, the road environment adjoining the site will be changed from rural to urban. The road environment will be upgraded to enable Site access as well as install and/or upgrade features associated with urban roads such as street lighting, kerb and channel guttering, signage, lane delineation and line-marking. Along with the increased pedestrian activity and traffic associated with the Project these measures are expected to reduce the existing traffic speeds along Turnock Street and Cudgen Road. • Advisory signage to mitigate impacts (movement and collisions with vehicles) due to the increase in traffic numbers along Cudgen Road and Turnock Street on fauna, particularly on the endangered population of Koalas, is currently being assessed in consultation with the OEH and is planned to continue until final lodgement of the EIS. • Any injured native fauna detected shall be rescued and transferred to a local veterinarian for treatment and/or WIRES for rehabilitation. • Monitoring of species mortality and injuries. Should an increase in Project related fauna mortalities/injuries occur, this will trigger investigation and adaptive management actions.	Low	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
Aviation	Operation	Aircraft strike	To avoid any impacts of aircraft strikes on threatened species of animals or on animals that are part of a TEC, all works and associated activities are to be delivered in accordance with an approved Fauna Management Plan (FMP) as per Section 3 of the Stage 2 BMP with detailed measures in Table 8 and Section 3.8.3. Mitigation measures include: • Aviation operations for the development will be conducted in accordance with an approved Aviation Operations Manual. This manual will identify areas of wildlife hazards including bird and flying fox activity such as the Elrond Drive and Kingscliff Library flying fox camps that are located within 1km of the Site (Ecosure, 2018, Greencap, 2018). The location of known flying fox camps will be included as either an 'avoid area' or a 'fly neighbourly' area; • Given the nature of hospital operational activity, aircraft movement will be avoided during peak periods of flying fox activity (i.e. hours preceding dusk and dawn) and at peak birdstrike times as reported in the Australian aviation wildlife strike statistics report (Australian Transport Safety Bureau, 2017). These details will also be incorporated into the Enroute Supplement Australia (ERSA) published by Airservices Australia. The ERSA is a publication which contains information vital for planning a flight and for in flight operations for the aircraft pilot. • The siting of the HLS and primary considerations in HLS approach and departure path selection included avoidance of ecologically and environmentally sensitive areas. The SSD general requirements of preferred flight path directions are detailed in the Aviation State Significant Development Report: Tweed Valley Hospital SSD-9575 (AviPro 2019). The planned flight approach and departure paths to the HLS run north-northeast to southwest, minimising any impact on the environmentally sensitive areas including flying fox camps; and • In accordance with section 9.4.2 of the BAM, the FMP outlines measures to monitor fauna at the Site, including species mortality resulting from	Low	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
			aircraft movement. The plan will outline objectives and thresholds for threatened species mortality, which in the event of exceedances will trigger investigation and adaptive management actions. Adaptive management actions may include auditory repellents, visual deterrents, and physical barriers where birds, bats and other animals are an issue.		

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range					
Habitat; established home range and connectivity	Construction	Removal of windrow vegetation in Zone 4 and 8.	To avoid any impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range, all works and associated activities are to be delivered in accordance with an approved; • Vegetation Management Plan (VMP) as per Section 2 of the Stage 2 BMP with detailed measures in Table 4 and 7; and • Fauna Management Plan (FMP) as per Section 3 of the Stage 2 BMP with detailed measures in Table 8 and Section 3.3. Mitigation measures include: • All native vegetation on the Site that is not approved for removal must be suitably protected during construction as per recommendations of Section 2.3.1 of the Stage 2 VMP as required by Conditions B33 and C25 of Schedule 3 for the duration of the construction works; • The vegetation maintenance program, including weed control activities, and regular monitoring and reporting including objectives and thresholds, which in the event of exceedances will trigger investigation and adaptive management actions. This will be undertaken to evaluate the progress and compliance with the VMP (See; Section 2.3.2 and 2.3.3 of the Stage 2 VMP); and • A suitably qualified and experienced fauna rescue person shall be present during vegetation clearing. A Fauna Management Procedure for vegetation and rock clearing activities on the Site is outlined in Section 3.7 of the Stage 2 FMP, including protocols to follow if koalas *Phascolarctos cinereus* are found on the Site during vegetation clearing works and/or earthworks.	Medium	Low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
	Both	Decrease in biodiversity values including connectivity and movement of threatened species that maintains their lifecycle	To avoid any impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range, all works and associated activities are to be delivered in accordance with an approved; • Vegetation Management Plan (VMP) as per Section 2 of the Stage 2 BMP with detailed measures in Table 4 and 7; and • Fauna Management Plan (FMP) as per Section 3 of the Stage 2 BMP with detailed measures in Table 8 and Section 3.3. Mitigation measures include: • The primary impact on movement of threatened species relates to boundary fencing of the Site. In respect of the current fencing on the site, the only existing permanent fencing in proximity to the site is the wildlife fencing along the Turnock St roadside. The Project will not impact this existing fencing. • Temporary boundary fencing has been installed during pre-construction works. This temporary fencing will be removed at the conclusion of the construction phase of the development. Temporary boundary fencing has been fitted with a 'post and bridge' system at least every 50 m in accordance with published guidelines (KRS 2009) to facilitate movement of koala *Phascolarctos cinereus* and other arboreal marsupials (See; Section 3.3.1 of the Stage 2 FMP). Wildlife-friendly is currently being assessed in consultation with the OEH and is planned to continue until final lodgement of the EIS; • As per the Stage 1 SSD application, there is no intent for a permanent boundary fence to be installed for the operations phase of the Project, thereby not impeding movement of threatened species; • To facilitate the movement of fauna, threatened species habitat and connections for foraging and dispersal, retained and enhanced vegetated buffer zones (MZs 6 and 7 in the VMP) will be substantial (augmented to a minimum of 10 m and 30 m wide) and representative of forest types being connected by these zones. Vegetated buffer zones will	Medium	Low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
			connect to the retained Subtropical Rainforest vegetation in the northern portion of the site and will run north to south in line with the mapped regional fauna corridor. This will provide important stepping-stone and refuge habitat for species connectivity. Revegetation and vegetation maintenance will be undertaken during Stage 2 works and is addressed in Section 2.3.3 and 2.3.4 of the VMP; • New plantings in the WSUD bio-detention basins, landscaped areas for filtering runoff and swale drains as part of Stage 2 works will treat both stormwater quality and contribute to providing a range of native habitat or 'moist corridors' across the site; • Where possible, landscaping will include habitat features such as rocks that have been salvaged from other areas of the Site (cleared windrows) that will create habitat for ground dwelling species (Turf, 2019); • The vegetation maintenance program, including weed control and restoration activities, and regular monitoring and reporting including objectives and thresholds which in the event of exceedances will trigger investigation and adaptive management actions, will be undertaken to evaluate the progress and compliance with the VMP (See; Section 2.3.2 and 2.3.3 of the Stage 2 VMP); • Weed removal will include removal of an exotic grassland monocultures of barner grass *Pennisetum purpureum* and of camphor laurel *Cinnamomum camphora* located amongst derived and remnant native vegetation in the northern section of the Site (Zone 9) and revegetation with appropriate native rainforest species. Currently there is a *Salvinia molesta* infestation in the dam located in the central northern section of the Site. Decommissioning the dam has been recommended to reduce ongoing control efforts of Salvinia as per Section 2.3.2.6 of the Stage 2 VMP; and • Where avoidance of light spill, airborne noise, vibration and dust generation is not practicable, key measures to mitigate the impact of potential disruption to threatened wildlife species or reduced viability of adjacent habitat and address residual impacts from light, noise, vibration or dust generated as a result of construction activities will be		

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
			implemented, as outlined in Section 3.9 of the FMP.		

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

Aspect	Project phase	Potential Impact	Mitigation	Risk before mitigation	Residual risk
Impacts of development on the habitat of threatened species or ecological communities associated with rocks					
Removal of wood or rocks along the windrows, particularly in Zone 4. Removal of native vegetation	Construction (Duration of vegetation clearing works and/or earthworks)	Death or injury to wildlife	To avoid any impacts of development on the on the habitat of threatened species or ecological communities associated with rocks, all works and associated activities are to be delivered in accordance with an approved Fauna Management Plan (FMP) as per Section 3 of the Stage 2 BMP with detailed measures in Table 8 and Section 3.7. Mitigation measures include: • For the duration of the construction works all native vegetation on the Site that is not approved for removal must be suitably protected during construction as per recommendations of Section 2.3.1 of the Stage 2 BMP as required by Conditions B33 and C25 of Schedule 3; and • A suitably qualified and experienced fauna rescue person shall be present during vegetation clearing. A Fauna Management Procedure for vegetation and rock clearing activities on the Site is outlined in Section 3.7 of the Stage 2 FMP.	Low	Very low

NOTE: This table should be read in conjunction with the following associated plans: Stage 1 Biodiversity Management Plan & Stage 2 Biodiversity Management Plan. These plans contain the detailed mitigation measures for the Project.

APPENDIX K. RISK MATRIX

		Probability				
		A	B	C	D	E
Maximum reasonable consequence	1	CR	CR	HR	HR	MR
	2	CR	HR	HR	MR	LR
	3	HR	HR	MR	LR	LR
	4	HR	MR	LR	LR	LR
	5	MR	LR	LR	LR	LR

CRITICAL	CR
HIGH RISK	HR
MODERATE RISK	MR
LOW RISK	LR

Consequence criteria: Impacts on threatened species and/or threatened species habitat
1. CRITICAL • Impact – Severe; Spatial scale – Widespread; Time scale – Long-term. • Requires consideration of whether impacts may result in a Serious and Irreversible Impact that may lead to local extinction.
2. MAJOR • Impact – Moderate; Spatial scale – Moderate to widespread; Time scale – Mid- to long-term. • May result in temporary or long-term damage.
3. MODERATE • Impact – Moderate; Spatial scale – Local to moderate; Time scale – Short- to mid-term. • May result in a moderate, temporary impact. However, it may be difficult to rehabilitate impact and may have negative implications on the ecosystem.
4. MINOR • Impact – Minor; Spatial scale – Local; Time scale – Short-term. • May result in minor impacts that are relatively easily rehabilitated. Not likely to have negative implications on the ecosystem.
5. NEGLIGIBLE • Impact – Minor; Time scale – Short-term with no lasting effect. • May result in negligible impacts that can be categorised as temporary, local and reversible.
Likelihood criteria
A. ALMOST CERTAIN • Very high or certain probability that impact will occur or event is of a continuous nature.
B. LIKELY • Likely probability that impact will occur or event is frequent (frequency 1-5 years).
C. MODERATE • Moderate probability that impact will occur or event is infrequent (frequency 5-20 years).
D. UNLIKELY • Low probability that impact will occur or event is very infrequent (frequency 100 years).
E. REMOTE • Very low probability that impact will occur or may occur under extenuating circumstances. Event is very rare of stochastic in nature (frequency 1000 years)

APPENDIX L. CREDIT SUMMARY REPORT

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00011608/BAAS17014/19/00011609	Tweed Valley Hospital - Impact assessment calculations	04/01/2019

Assessor Name	Report Created	BAM Data version *
Damian Licari	22/01/2019	6

Assessor Number

BAAS18006

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Candidate SAII	Ecosystem credits
White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion								
1	1302_Z4_Self-sown_windrow	10.6	0.6	0.25	High Sensitivity to Potential Gain	2.00		0

2	1302_Z8_Self-sown_windrow	16.8	0.4	0.25	High Sensitivity to Potential Gain	2.00		3
							Subtotal	**3**
							Total	**3**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Candidate SAII	Species credits
Coeranoscincus reticulatus / Three-toed Snake-tooth Skink (Fauna)						
1302_Z4_Self-sown_windrow	10.6	0.55	0.25	2	False	3
1302_Z8_Self-sown_windrow	16.8	0.4	0.25	2	False	3
					Subtotal	**6**
Cryptocarya foetida / Stinking Cryptocarya (Flora)						
1302_Z8_Self-sown_windrow	N/A	1	0.25	1.5	False	2
					Subtotal	**2**

Ninox strenua / Powerful Owl (Fauna)						
1302_Z4_Self-sown_windrow	10.6	0.55	0.25	2	N/A	3
1302_Z8_Self-sown_windrow	16.8	0.4	0.25	2	N/A	3
					Subtotal	**6**

APPENDIX M. BIODIVERSITY CREDIT REPORT

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00011608/BAAS17014/19/00011609

Proposal Name
Tweed Valley Hospital - Impact assessment calculations

BAM data last updated *
04/01/2019

Assessor Name
Damian Licari

Assessor Number
BAAS18006

BAM Data version *
6

Proponent Names
Jacqueline Hawkins ,

Report Created
22/01/2019

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Candidate Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

BAM Biodiversity Credit Report (Like for like)

No Changes

Ecosystem Credit Summary

PCT	TEC	Area	Credits
1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	1.0	3.00

Credit classes for 1302

Like-for-like options

Any PCT with the below TEC	Containing HBT	In the below IBRA subregions
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions (including PCT's 669, 670, 770, 845, 886, 887, 1068, 1201, 1275, 1302, 1525, 1527, 1528, 1529, 1533, 1534, 1535, 1541, 1545)	No	Burringbar-Conondale Ranges,Scenic Rim and Sunshine Coast-Gold Coast Lowlands. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Coeranoscincus reticulatus / Three-toed Snake-tooth Skink	1.0	6.00

Cryptocarya foetida / Stinking Cryptocarya	1.0	2.00
Ninox strenua / Powerful Owl	1.0	6.00

Coeranoscincus reticulatus/ Three-toed Snake-tooth Skink	1302_Z4_Self-sown_windrow	**Like-for-like options**	
		Only the below Spp	In the below IBRA subregions
		Coeranoscincus reticulatus/Three-toed Snake-tooth Skink	Any in NSW
	1302_Z8_Self-sown_windrow	**Like-for-like options**	
		Only the below Spp	In the below IBRA subregions
		Coeranoscincus reticulatus/Three-toed Snake-tooth Skink	Any in NSW
Cryptocarya foetida/ Stinking Cryptocarya	1302_Z8_Self-sown_windrow	**Like-for-like options**	
		Only the below Spp	In the below IBRA subregions
		Cryptocarya foetida/Stinking Cryptocarya	Any in NSW

Cryptocarya foetida/ Stinking Cryptocarya	1302_Z8_Self-sown_windrow	
Ninox strenua/ Powerful Owl	1302_Z4_Self-sown_windrow	**Like-for-like options**
		Only the below Spp / In the below IBRA subregions
		Ninox strenua/Powerful Owl / Any in NSW
	1302_Z8_Self-sown_windrow	**Like-for-like options**
		Only the below Spp / In the below IBRA subregions
		Ninox strenua/Powerful Owl / Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00011608/BAAS17014/19/00011609

Proposal Name
Tweed Valley Hospital - Impact assessment calculations

BAM data last updated *
04/01/2019

Assessor Name
Damian Licari

Assessor Number
BAAS18006

BAM Data version *
6

Proponent Name(s)
Jacqueline Hawkins ,

Report Created
22/01/2019

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Candidate Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

BAM Biodiversity Credit Report (Variations)

No Changes

Ecosystem Credit Summary

PCT	TEC	Area	Credits
1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	1.0	3.00

Credit classes for 1302

Like-for-like options

Any PCT with the below TEC	Containing HBT	In the below IBRA subregions
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions (including PCT's 669, 670, 770, 845, 886, 887, 1068, 1201, 1275, 1302, 1525, 1527, 1528, 1529, 1533, 1534, 1535, 1541, 1545)	No	Burringbar-Conondale Ranges,Scenic Rim and Sunshine Coast-Gold Coast Lowlands. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Any PCT in the below Formation	And in any of below trading groups	Containing HBT	In the below IBRA regions/subregions
Rainforests	Tier 3 or higher	No	IBRA Region: South Eastern Queensland, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Variations)

Species Credit Summary

Species	Area	Credits
Coeranoscincus reticulatus / Three-toed Snake-tooth Skink	1.0	6.00
Cryptocarya foetida / Stinking Cryptocarya	1.0	2.00
Ninox strenua / Powerful Owl	1.0	6.00

<table>
<tr><td rowspan="6">Coeranoscincus reticulatus/
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<tr><td>Only the below Spp</td><td colspan="2">In the below IBRA subregions</td></tr>
<tr><td>Coeranoscincus reticulatus/Three-toed Snake-tooth Skink</td><td colspan="2">Any in NSW</td></tr>
<tr><td colspan="3">Variation options</td></tr>
<tr><td>Any Spp in the below Kingdom</td><td>Any species with same or higher category of listing under Part 4 of teh BC Act showb below</td><td>In the below IBRA subregions</td></tr>
<tr><td>Fauna</td><td>Vulnerable</td><td>Burringbar-Conondale Ranges,Scenic Rim and Sunshine Coast-Gold Coast Lowlands.
or
Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</td></tr>
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Coeranoscincus reticulatus/ Three-toed Snake-tooth Skink	1302_Z8_Self-sown_windrow	**Like-for-like options**		
		Only the below Spp	In the below IBRA subregions	
		Coeranoscincus reticulatus/Three-toed Snake-tooth Skink	Any in NSW	
		Variation options		
		Any Spp in the below Kingdom	Any species with same or higher category of listing under Part 4 of teh BC Act showb below	In the below IBRA subregions
		Fauna	Vulnerable	Burringbar-Conondale Ranges,Scenic Rim and Sunshine Coast-Gold Coast Lowlands. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Cryptocarya foetida/ Stinking Cryptocarya	1302_Z8_Self-sown_windrow	**Like-for-like options**		
		Only the below Spp	In the below IBRA subregions	
		Cryptocarya foetida/Stinking Cryptocarya	Any in NSW	
		Variation options		
		Any Spp in the below Kingdom	Any species with same or higher category of listing under Part 4 of teh BC Act	In the below IBRA subregions

			showb below	
		Flora	Vulnerable	Burringbar-Conondale Ranges,Scenic Rim and Sunshine Coast-Gold Coast Lowlands. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Ninox strenua/ Powerful Owl	1302_Z4_Self-sown_windrow	**Like-for-like options**		
		Only the below Spp	In the below IBRA subregions	
		Ninox strenua/Powerful Owl	Any in NSW	
		Variation options		
		Any Spp in the below Kingdom	Any species with same or higher category of listing under Part 4 of teh BC Act showb below	In the below IBRA subregions
		Fauna	Vulnerable	Burringbar-Conondale Ranges,Scenic Rim and Sunshine Coast-Gold Coast Lowlands. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

<table>
<tr><td rowspan="6">Ninox strenua/ Powerful Owl</td><td rowspan="6">1302_Z8_Self-sown_windrow</td><td colspan="3">Like-for-like options</td></tr>
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