ARBORICULTRAL ASSESSMENT

[redacted]

BALCATTA REFUSE CENTRE / BALCATTA

[redacted]

28/03/2019

Re: Pre-development assessment of trees within the Balcatta Refuse Centre

[redacted]

Please find attached the report regarding your request to provide a population survey on the multiple trees located within the Balcatta Refuse Centre. If you would like any further information regarding matters contained in the report please call me anytime during normal business hours.

[redacted]

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1 - SUMMARY – The development of the Balcatta Refuse Centre has necessitated an inspection and survey of all trees within the boundaries, to assess the retention potential of specimens and the possibility of plan amendments. The report considered several factors in relation to each tree or group of trees and provides a retention value and transplant potential for the trees in the overall site.

2 - INTRODUCTION

2.1 Barry Elswood from The City of Stirling has requested a survey of the tree population inside the boundaries of the current Balcatta refuse centre, owned and operated by the City. The initial development plan (see Image below) suggested an almost blank canvas in which most trees had been removed.

Image 1 – design proposal diagram

2.2 The scope of the report was to provide information based on the following proposal;

- height range in 5 metre increments
- diameter at breast height so the Tree Protection Zone can be calculated (unless many small trees in a group when we can average and set a perimeter limit)
- diameter at ground level so the Structural Root Zone can be calculated (unless many small trees in a group when this is only necessary for larger perimeter trees)
- a GPS location for each tree or group
- vitality
- structural condition, including faults or defects
- diseases or pests
- whether it is a weed species or likely to take over the site if left unmanaged
- a current life expectancy if left as is
- a digital image of each tree

Concluding information which will have considered in part the design proposal plans you provided, will include;

- a Tree retention value from Low to Very High
- whether the tree can be and is worth transplanting with reference to approximate costs
- a TPZ zone and SRZ zone about each tree to consider in the development process

2.3 For ease of reference the site was separated into ten easily definable zones inside of which the tree population was assessed.

2.4 During the pre-inspection walkover and survey it was noted that several trees may be worthy of consideration for transplanting. Due to ease of excavation, limited preparation time required, and good re-establishment rates the species noted commonly have a higher success rate. Larger potential transplants do take significant preparation time (up to twelve months) and incur large lifting machinery expenses. This should be considered as one tree can absorb large amounts of allocated budgets. Specific specimens were noted to be significant trees with native, cultural and habitat value while some presented as weed species and/or non-natives which may have opportunistically established in the site.

2.5 The site now and post development completion must retain a sump area where water is collected. The current sump which was dry at the time of the walkover and survey is surrounded predominantly with what would be listed as weed and some Australian but not necessarily Western Australian native species.

2.6 Two significant stands of native trees were noted in the north east and south west corners where some large and significant native trees exist. These include Tuart, Jarrah and smaller species such as Banksias. It was suggested that efforts to amend the site to retain these areas would be well worth while if soil samples indicated the area were free of harmful pathogens such as *Phytophthora spp.*

2.7 It was noted that alternative build options with regard to building over tree roots (e.g. ARBORGRID)) could be considered and allow parking areas right amongst tree populations without affecting tree health and vitality. Additionally, "No Dig" roads and pathways were discussed where tree roots are not affected, as well as the installation of permeable and porous material over geotextile and aggregate in the tree TPZ areas.

2.8 Due to the intense grouping and close proximity in some areas, some trees were listed in groups. These appear in Table 1 as T59, T77 and T187. The group findings are general observations for the trees within that group and management considerations may see individual trees with the group retained or removed depending on the current vitality at the time of future works.

2.9 The 'Retention Value' of the trees was based on the following criteria and did not consider where the trees sit within the current design plan for the site. The trees were listed for retention as Low, Medium, High or Very High based on a combination of several values:

- Tree vitality
- Structural condition
- Age/size
- Life expectancy
- Species profile - native vs introduced/weed species
- Other factors – aesthetics, remnant, habit etc

The higher the tree scores in all fields the higher the retention value.

3 SITE MAPS, DETAILS AND TABLES

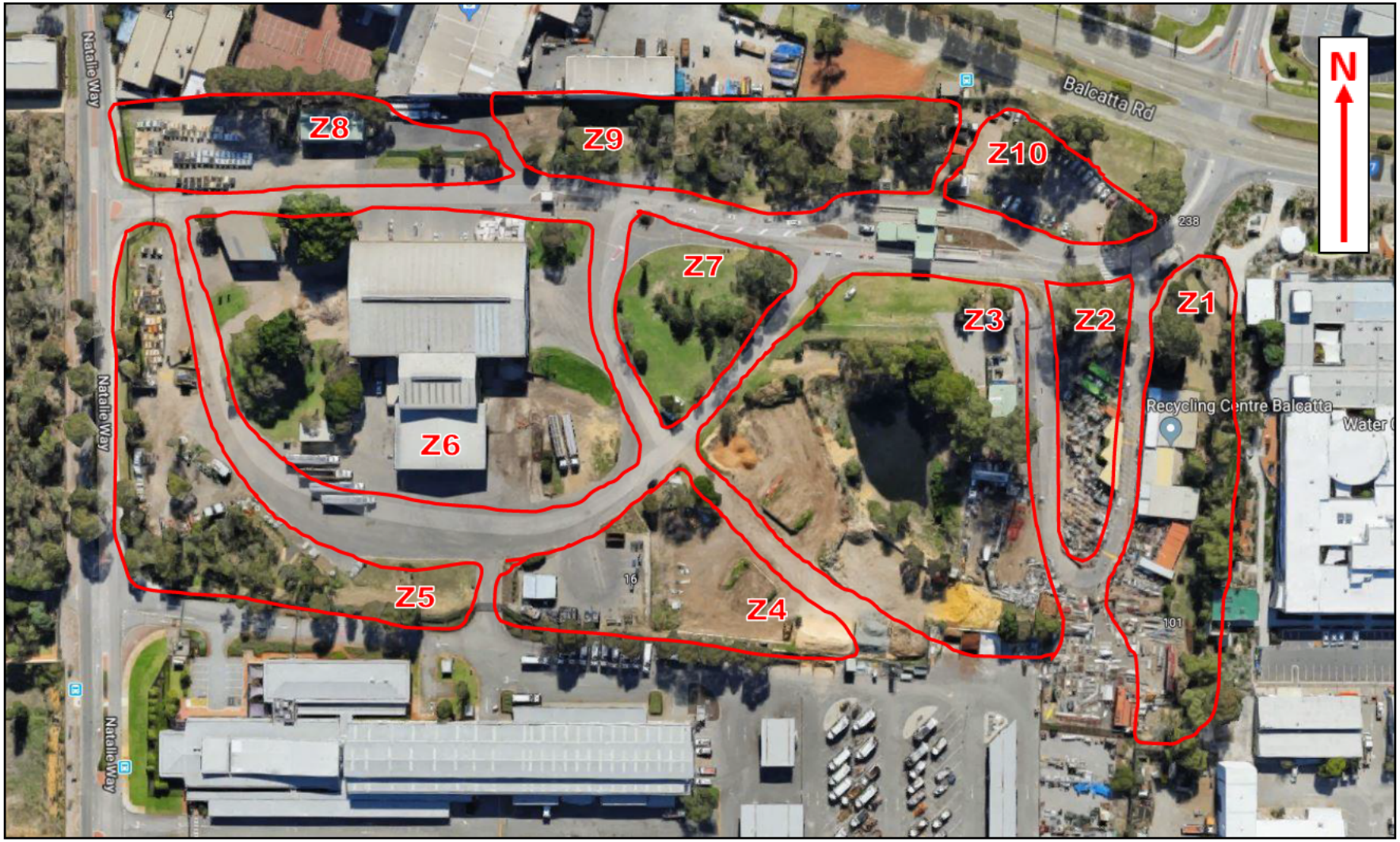
3.1 The site map on Page 6 provides an overhead image with the area separated into zones for ease of reference.

3.2 The site Tree map shows a screen shot of the GPS highlighted trees from "Tree Plotter".

The "Tree Plotter" access details are below;

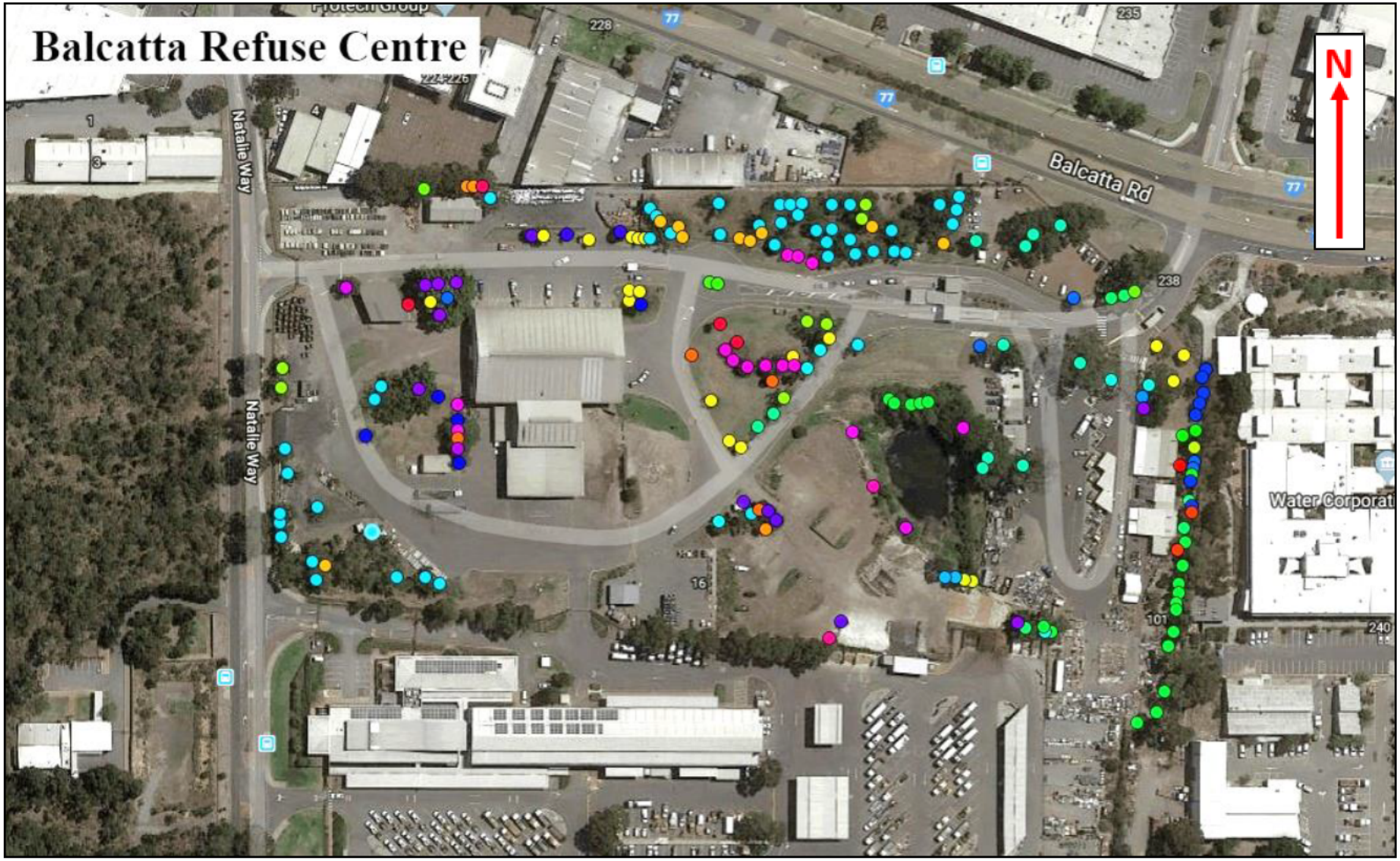
3.3 The tree details tables are on pages 8 to 13. It is considered that the report is best reviewed with the tables available to be referred to as the Tree plotter maps are viewed online. This will permit ease of cross reference between the many areas that need to be considered with regard to the trees and the site development.

3.1 Site Map



IMG 3 – Showing the location of the 10 zone areas. Image courtesy of Google.

3.2 Tree Map



IMG 4 – Showing GPS locations of all trees surveyed. Information avaiable in digital form via Tree Plotter (details supplied).

3.3 Tree details

TREE No.	SPECIES	ZONE	HEIGHT (m)	DBH (mm)	DGL (mm)	TPZ (m)	SRZ (m)	VITALITY	STRUCTURAL CONDITION	P/D	WEED SPP.	LIFE EXPECT.	RETENTION VALUE	TRANSPLANT ?
T 1	*Callistemon viminalis*	Z1	0-5	180	560	2.16	2.59	Mod	G – stem removal	Frass	N	10-20	M	Y
T 2	*Callistemon viminalis*	Z1	0-5	120	460	2	1.5	Mod	G – Multi stem	N	N	10-20	M	Y
T 3	*Callistemon viminalis*	Z1	0-5	100	310	2	2	Mod	G – Multi stem	N	N	10-20	M	Y
T 4	*Eucalyptus grandis*	Z1	25-30	580	670	6.96	2.8	High	M – Fractures	N	N	40-100	M	N
T 5	*Eucalyptus robusta*	Z1	10-15	430	520	5.16	2.51	Mod	M – Suppressed	N	N	10-20	M	N
T 6	*Ficus microcarpa var Hillii*	Z1	5-10	290/370	460	5.64	2.39	High	G	N	N	40-100	M	Y
T 7	*Eucalyptus sideroxylon*	Z1	5-10	240	280	2.88	1.94	Mod	M – Suppressed	N	N	0-10	L	N
T 8	*Eucalyptus sideroxylon*	Z1	10-15	540	560	6.48	2.59	High	G – Minor DW	N	N	40-100	H	N
T 9	*Eucalyptus sideroxylon*	Z1	10-15	260	270	3.12	1.91	High	G	N	N	40-100	M	N
T 10	*Eucalyptus sideroxylon*	Z1	5-10	290	380	3.48	2.2	Low	M – Dieback	N	N	0-10	L	N
T 11	*Eucalyptus sideroxylon*	Z1	0-5	240	240	2.88	1.82	High	M- Leaning	N	N	10-20	M	N
T 12	*Eucalyptus camaldulensis*	Z1	20-25	630	870	7.56	3.12	High	G	N	N	40-100	H	N
T 13	*Casuarina obesa*	Z1	5-10	270	530	3.24	2.53	High	G	N	N	20-40	M	N
T 14	*Eucalyptus rudis*	Z1	5-10	190	230	2.28	1.79	High	G	N	N	20-40	M	N
T 15	*Eucalyptus rudis*	Z1	0-5	200	250	2.4	1.85	High	G	N	N	20-40	M	N
T 16	*Eucalyptus camaldulensis*	Z1	15-20	400	460	4.8	2.39	High	G	N	N	40-100	H	N
T 17	*Eucalyptus camaldulensis*	Z1	0-5	35	45	2	1.5	High	G	N	N	10-20	L	Y
T 18	*Acacia saligna*	Z1	0-5	900	150	10.8	1.5	High	M	N	Y	10-20	L	N
T 19	*Eucalyptus sideroxylon*	Z1	10-15	380	410	4.56	2.28	High	G -Minor suppress	N	N	40-100	H	N
T 20	*Eucalyptus conferruminata*	Z1	0-5	900	140	10.8	1.5	Mod	P –Suppressed	N	N	0-10	L	N
T 21	*Eucalyptus sideroxylon*	Z1	5-10	170	230	2.04	1.79	Mod	M – Lean	N	N	10-20	M	N
T 22	*Agonis flexuosa*	Z1	5-10	260/290	590	4.68	2.65	High	G	N	N	40-100	H	N
T 23	*Eucalyptus conferruminata*	Z1	0-5	90/90	100/100	2	1.5	Mod	P – Lean twin/stem	N	N	0-10	L	N
T 24	*Euc. camaldulensis obtusa*	Z1	15-20	590/610	830	10.2	3.06	High	M	N	N	40-100	H	N
T 25	*Agonis flexuosa*	Z1	0-5	270	340	3.24	2.1	High	G	N	N	20-40	M	N
T 26	*Euc. camaldulensis obtusa*	Z1	15-20	540	640	6.48	2.74	High	G - Failures	N	N	40-100	H	N
T 27	*Euc. camaldulensis obtusa*	Z1	5-10	120	200	2	1.68	High	G –Twin stem	N	N	10-20	L	N
T 28	*Euc. camaldulensis obtusa*	Z1	15-20	200	230	2.4	1.79	High	M – 9 Stem clump	N	N	40-100	M	N
T 29	*Euc. camaldulensis obtusa*	Z1	10-15	160/160	220/220	2.76	2.02	High	M- 4 Stem clump	N	N	40-100	M	N
T 30	*Euc. camaldulensis obtusa*	Z1	10-15	190	230	2.28	1.79	High	M- 6 Stem clump	N	N	40-100	M	N

TREE No.	SPECIES	ZONE	HEIGHT (m)	DBH (mm)	DGL (mm)	TPZ (m)	SRZ (m)	VITALITY	STRUCTURAL CONDITION	P/D	WEED SPP.	LIFE EXPECT.	RETENTION VALUE	TRANSPLANT ?
T 31	*Euc. camaldulensis obtusa*	Z1	10-15	240	280	2.88	1.94	High	M – 5 Stem clump	N	N	40-100	M	N
T 32	*Euc. camaldulensis obtusa*	Z1	15-20	690	830	8.28	3.06	High	M – Failures, lean	N	N	40-100	H	N
T 33	*Euc. camaldulensis obtusa*	Z1	15-20	540	660	6.48	2.78	Mod	M – Failures	N	N	20-40	H	N
T 34	*Euc. camaldulensis obtusa*	Z1	15-20	780	910	9.36	3.18	High	G – Small failures	N	N	40-100	H	N
T 35	*Euc. camaldulensis obtusa*	Z1	0-5	80	130	2	1.5	High	M	N	N	10-20	L	N
T 36	*Eucalyptus grandis*	Z2	10-15	310	390	3.72	2.23	High	G – In island	N	N	40-100	M	N
T 37	*Eucalyptus gomphocephala*	Z2	25-30	63/73/70/79	80/82/65/85	15	4	High	G – 4 Stem	Canker	N	40-100	VH	N
T 38	*Eucalyptus gomphocephala*	Z3	10-15	410/510	650	7.8	2.76	High	G	N	N	40-100	H	N
T 39	*Eucalyptus rudis*	Z3	5-10	340	400	4.08	2.25	High	G	N	N	20-40	M	N
T 40	*Eucalyptus marginata*	Z3	10-15	450/390	540	7.2	2.55	Low	M - Dieback	N	N	0-10	M	N
T 41	*Eucalyptus gomphocephala*	Z3	25-30	1240	1240	14.88	3.62	High	G	Bracket	N	40-100	H	N
T 42	*Euc. camaldulensis obtusa*	Z3	0-5	150	180	2	1.61	High	G – Suppressed	N	N	20-40	L	N
T 43	*Eucalyptus leucoxylon*	Z3	0-5	180	200	2.16	1.68	High	G – Suppressed	N	N	20-40	L	N
T 44	*Euc. camaldulensis obtusa*	Z3	10-15	580	690	6.96	2.83	High	G	N	N	40-100	L	N
T 45	*Eucalyptus conferruminata*	Z3	0-5	270	350	3.24	2.13	High	M - Suppressed	N	N	20-40	L	N
T 46	*Ficus microcarpa var. hillii*	Z3	5-10	410	450	4.92	2.37	High	G	N	N	40-100	L	N
T 47	*Casuarina cunninghamiana*	Z3	0-5	150/130	260	2.4	1.88	Mod	P - Suppressed	N	N	0-10	L	N
T 48	*Casuarina cunninghamiana*	Z3	10-15	350	450	4.2	2.37	High	G	N	N	20-40	L	N
T 49	*Eucalyptus melliodora*	Z3	10-15	370	260	4.44	1.88	High	G	N	N	20-40	M	N
T 50	*Eucalyptus melliodora*	Z3	10-15	380	450	4.56	2.37	High	P – In bank edge	N	N	20-40	L	N
T 51	*Melia azedarach*	Z3	5-10	150	450	2	2.37	Mod	P – In bank edge	N	Y	0-10	L	N
T 52	*Ricinus communis*	Z3	0-5	100	500	2	2.47	Low	P – In bank edge	N	Y	0-10	L	N
T 53	*Melia azedarach*	Z3	5-10	250	300	3	2	High	G	N	Y	0-10	L	N
T 54	*Euc. camaldulensis obtusa*	Z3	10-15	480	180	5.76	1.61	High	M – soil level	N	N	20-40	L	N
T 55	*Euc. camaldulensis obtusa*	Z3	5-10	220	380	2.64	2.2	High	M – soil level	N	N	20-40	M	N
T 56	*Euc. camaldulensis obtusa*	Z3	15-20	490	640	5.88	2.74	High	M – soil level	N	N	20-40	L	N
T 57	*Euc. camaldulensis obtusa*	Z3	10-15	460	260	5.52	1.88	High	M – soil level	N	N	20-40	M	N
T 58	*Euc. camaldulensis obtusa*	Z3	10-15	510	550	6.12	2.57	High	M – Suppressed	N	N	20-40	M	N
T 59	*Melia azedarach Group*	Z3	5-10	Various	Various	5m +	2.5+	High	M – many in bank	N	Y	20-40	M	N
T 60	*Eucalyptus gomphocephala*	Z3	20-25	510/590/530	670/560/670	11.28	3.44	High	G – 3 stems	N	N	40-100	VH	N
T 61	*Eucalyptus gomphocephala*	Z3	10-15	650	700	7.8	2.76	High	G – mod suppressed	N	N	40-100	H	N
T 62	*Eucalyptus leucoxylon*	Z4	0-5	270	320	3.24	1.91	High	G	N	N	20-40	M	N
T 63	*Eucalyptus marginata*	Z4	10-15	750	860	9	3.11	High	M - Basal wound	N	N	20-40	H	N

TREE No.	SPECIES	ZONE	HEIGHT (m)	DBH (mm)	DGL (mm)	TPZ (m)	SRZ (m)	VITALITY	STRUCTURAL CONDITION	P/D	WEED SPP.	LIFE EXPECT.	RETENTION VALUE	TRANSPLANT ?
T 64	*Ficus benjamina*	Z4	0-5	110	190	2	1.65	High	G	N	N	20-40	L	Y
T 65	*Araucaria columnaris*	Z4	0-5	130	170	2	1.57	High	P – Suppressed	N	N	0-10	L	Y
T 66	*Ficus benjamina*	Z4	10-15	290/290/220	400	5.64	2.25	High	M – Side pruned	N	N	10-20	L	Y
T 67	*Ficus benjamina*	Z4	10-15	310	380	3.72	2.2	High	M – Side pruned	N	N	10-20	L	Y
T 68	*Araucaria heterophylla*	Z4	10-15	300	320	3.6	2.05	High	G	N	N	20-40	L	Y
T 69	*Ficus benjamina*	Z4	0-5	200	N/A	2.4	1.5	High	P – In pipe	N	N	10-20	L	N
T 70	*Shinus terebinthifolius*	Z4	0-5	N/A	N/A	2	1.5	Mod	P - Cluster	N	Y	0-10	L	N
T 71	*Eucalyptus marginata*	Z5	5-10	220/220	260/270	3.72	2.18	Low	M- 2 stem	N	N	0-10	L	N
T 72	*Eucalyptus marginata*	Z5	0-5	510	370	6.12	2.18	High	G	N	N	20-40	M	N
T 73	*Eucalyptus marginata*	Z5	10-15	570	710	6.84	2.87	High	G	N	N	20-40	H	N
T 74	*Eucalyptus marginata*	Z5	10-15	730	780	8.76	2.98	Low	P –Damage	N	N	0-10	L	N
T 75	*Eucalyptus marginata*	Z5	10-15	540	600	6.48	2.67	High	M –Lean	N	N	40-100	H	N
T 76	*Eucalyptus marginata*	Z5	10-15	360	440	4.32	2.34	Mod	M – Stem wound	N	N	20-40	H	N
T 77	*Banksia, Jarrah Group*	Z5	0-10	Various	Various	4+	2+	High	G	N	N	20-40	H	N
T 78	*Eucalyptus marginata*	Z5	5-10	270	280	3.24	1.94	High	M –Wounds, 3 stem	N	N	40-100	H	N
T 79	*Eucalyptus marginata*	Z5	5-10	300	300	3.6	2	High	G – 3 in a group	N	N	40-100	H	N
T 80	*Eucalyptus marginata*	Z5	10-15	770	840	9.24	3.08	High	G	N	N	40-100	H	N
T 81	*Eucalyptus marginata*	Z5	5-10	480	540	5.76	2.55	Poor	M	N	N	0-10	M	N
T 82	*Eucalyptus marginata*	Z5	5-10	320	380	3.84	2.2	High	M - Wounds	N	N	20-40	H	N
T 83	*Eucalyptus marginata*	Z5	5-10	300/310/200	360/330/250	5.76	2.57	High	G – Wounds, 3 stem	N	N	40-100	H	N
T 84	*Corymbia calophylla*	Z5	0-5	100/100	250	2	1.85	Low	P	N	N	0-10	M	N
T 85	*Corymbia calophylla*	Z5	5-10	330	370	3.96	2.18	High	G	N	N	20-40	M	N
T 86	*Melaleuca quinquenervia*	Z6	5-10	280	760	3.36	2.95	High	G – Multi Stem	N	N	20-40	H	N
T 87	*Washingtonia robusta*	Z6	5-10	440	440	5.28	2.34	High	G	N	N	20-40	M	Y
T 88	*Ficus microcarpa var. Hillii*	Z6	10-15	480/570	670	9	2.8	Mod	G – 2 Stem	N	N	40-100	M	Y
T 89	*Ficus microcarpa var. Hillii*	Z6	10-15	550	550	6.6	2.57	Mod	G	N	N	40-100	M	Y
T 90	*Ficus microcarpa var. Hillii*	Z6	10-15	640	660	7.68	2.78	Mod	G – Single stem	N	N	40-100	M	Y
T 91	*Eucalyptus rudis*	Z6	5-10	290	320	3.48	2.05	High	P –Suppressed	N	N	10-20	L	N
T 92	*Callistemon viminalis*	Z6	0-5	140	210	2	1.72	High	P – Suppressed	N	N	10-20	L	N
T 93	*Ficus microcarpa var. Hillii*	Z6	10-15	470	520	5.64	2.51	High	G	N	N	20-40	M	N
T 94	*Eucalyptus spathulata*	Z6	0-5	260	300	3.12	2	Mod	M- Suppressed	N	N	10-20	L	N
T 95	*Ficus microcarpa var. Hillii*	Z6	15-20	780	780	9.36	2.98	High	G	N	N	40-100	H	N
T 96	*Eucalyptus marginata*	Z6	10-15	910	1080	10.92	3.42	Mod	M – Basal damage	N	N	40-100	H	N

TREE No.	SPECIES	ZONE	HEIGHT (m)	DBH (mm)	DGL (mm)	TPZ (m)	SRZ (m)	VITALITY	STRUCTURAL CONDITION	P/D	WEED SPP.	LIFE EXPECT.	RETENTION VALUE	TRANSPLANT ?
T 97	*Eucalyptus marginata*	Z6	5-10	300/320/280	350/360/410	6.24	2.76	High	G – 3 Stem	N	N	40-100	H	N
T 98	*Eucalyptus spathulata*	Z6	0-5	370	510	4.44	2.49	High	M –Wound, Stake	N	N	20-40	M	N
T 99	*Melia azedarach*	Z6	0-5	90	100	2	1.5	High	G	N	Y	20-40	L	N
T 100	*Eucalyptus spathulata*	Z6	5-10	230	370	2.76	2.18	Low	M – Wounds	N	N	0-10	L	N
T 101	*Melia azedarach*	Z6	10-15	290/410	400/480	6	2.71	High	G – two stem	N	Y	20-40	M	N
T 102	*Araucaria columnaris*	Z6	5-10	200	230	2.4	1.79	High	P – Suppressed	N	N	10-20	L	N
T 103	*Ficus obliqua*	Z6	10-15	320	290	3.84	1.97	High	G	N	N	20-40	M	N
T 104	*Eucalyptus spathulata*	Z6	5-10	350	350	4.2	2.13	High	M – Wound	Bracket	N	10-20	L	N
T 105	*Callistemon viminalis*	Z6	0-5	90	150	2	1.5	Poor	M	N	N	0-10	L	N
T 106	*Callistemon viminalis*	Z6	0-5	110	190	2	1.65	Mod	M	N	N	0-10	L	N
T 107	*Callistemon viminalis*	Z6	0-5	120	290	2	1.97	Mod	M	N	N	0-10	L	N
T 108	*Eucalyptus spathulata*	Z6	5-10	410	450	4.92	2.37	High	M - Lean	N	N	20-40	M	N
T 109	*Dypsis decaryi*	Z7	0-5	370	370	4.44	2.18	High	G – Roundabout	N	N	20-40	L	Y
T 110	*Dypsis decaryi*	Z7	0-5	340	340	4.08	2.1	High	G – Roundabout	N	N	20-40	L	Y
T 111	*Araucaria columnaris*	Z7	5-10	220	270	2.64	1.91	High	G	N	N	20-40	L	Y
T 112	*Washingtonia robusta*	Z7	5-10	440	440	5.28	2.34	High	G	N	N	20-40	M	Y
T 113	*Corymbia calophylla*	Z7	5-10	290/370	470	5.64	2.41	High	G - Wound, Stake	N	N	20-40	M	N
T 114	*Corymbia calophylla*	Z7	10-15	620	780	7.44	2.98	High	G	Canker	N	20-40	M	N
T 115	*Callistemon viminalis*	Z7	0-5	150/130	450	2.4	2.37	High	G	N	N	20-40	M	N
T 116	*Eucalyptus leucoxylon*	Z7	0-5	180	230	2	1.79	High	G	N	N	20-40	M	N
T 117	*Eucalyptus leucoxylon*	Z7	5-10	400/240	530	5.64	2.53	High	G – Twin Stem	N	N	20-40	M	N
T 118	*Corymbia calophylla*	Z7	10-15	290/270/420	570	6.96	2.61	High	G – 3 Stem	Canker	N	20-40	M	N
T 119	*Eucalyptus erythrocorys*	Z7	0-5	170	240	2.04	1.82	High	M – Bend	N	N	10-20	L	N
T 120	*Eucalyptus erythrocorys*	Z7	0-5	220	290	2.64	1.97	Mod	M – Canopy decline	N	N	10-20	L	N
T 121	*Callistemon viminalis*	Z7	0-5	190	280	2.28	1.94	High	G	N	N	10-20	L	N
T 122	*Callistemon viminalis*	Z7	0-5	360/200	360/290	4.92	2.39	High	G	N	N	10-20	L	N
T 123	*Callistemon viminalis*	Z7	0-5	N/A	440	4.8	2.34	High	G	N	N	10-20	L	N
T 124	*Araucaria columnaris*	Z7	5-10	280	360	3.36	2.15	High	G	N	N	20-40	M	Y
T 125	*Washingtonia robusta*	Z7	0-5	N/A	N/A	1.5	1	High	G	N	N	20-40	M	Y
T 126	*Phoenix canariensis*	Z7	0-5	N/A	N/A	2	1.5	High	G	N	N	20-40	M	Y
T 127	*Phoenix canariensis*	Z7	0-5	N/A	N/A	2	1.5	High	G	N	N	20-40	M	Y
T 128	*Phoenix canariensis*	Z7	5-10	N/A	N/A	2	1.5	High	G	N	N	20-40	M	Y
T 129	*Phoenix canariensis*	Z7	5-10	N/A	N/A	2	1.5	High	G	N	N	20-40	M	Y

TREE No.	SPECIES	ZONE	HEIGHT (m)	DBH (mm)	DGL (mm)	TPZ (m)	SRZ (m)	VITALITY	STRUCTURAL CONDITION	P/D	WEED SPP.	LIFE EXPECT.	RETENTION VALUE	TRANSPLANT ?
T 130	*Phoenix canariensis*	Z7	5-10	N/A	N/A	2	1.5	High	G	N	N	20-40	M	Y
T 131	*Butia capitata*	Z7	0-5	N/A	N/A	1.5	1	High	G	N	N	20-40	M	Y
T 132	*Phoenix canariensis*	Z7	0-5	N/A	N/A	2	1.5	High	G	N	N	20-40	M	Y
T 133	*Corymbia maculata*	Z8	5-10	180	250	2.16	1.85	High	G – Root exposure	N	N	10-20	L	N
T 134	*Araucaria heterophylla*	Z8	0-5	60	80	1.5	1	High	G – Suppressed	N	N	10-20	L	Y
T 135	*Araucaria heterophylla*	Z8	0-5	70	80	1.5	1	High	G – Suppressed	N	N	10-20	L	Y
T 136	*Washingtonia filifera*	Z8	0-5	N/A	N/A	1.5	1	High	G – Suppressed	N	N	10-20	L	Y
T 137	*Eucalyptus marginata*	Z8	10-15	480/500/380	580/610/470	9.48	3.25	High	M – Basal Wounds	N	N	20-40	H	N
T 138	*Ficus benjamina*	Z8	5-10	N/A	260	3	1.88	High	G	N	N	40-100	M	Y
T 139	*Callistemon viminalis*	Z8	5-10	260/250	420	4.32	2.3	High	G	N	N	20-40	M	N
T 140	*Eucalyptus utilis*	Z8	0-5	340	370	4.08	2.18	High	M	N	N	10-20	M	N
T 141	*Callistemon viminalis*	Z8	0-5	170	360	2.04	2.15	High	M – Stem damage	N	N	10-20	M	N
T 142	*Eucalyptus utilis*	Z9	5-10	310	430	3.72	2.32	High	M – Basal hollow	N	N	20-40	M	N
T 143	*Callistemon viminalis*	Z9	0-5	110/110	230	2	1.79	High	P – Stem fracture	N	N	10-20	M	N
T 144	*Callistemon viminalis*	Z9	5-10	180/70	450	2	2.37	Mod	M	N	N	10-20	M	N
T 145	*Callistemon viminalis*	Z9	0-5	150/100	280	2.16	1.94	High	M – Lean	N	N	10-20	M	N
T 146	*Eucalyptus marginata*	Z9	5-10	190	240	2.28	1.82	High	G	N	N	40-100	H	N
T 147	*Eucalyptus marginata*	Z9	10-15	270	310	3.24	2.02	High	G – 7 Stem	N	N	40-100	H	N
T 148	*Eucalyptus marginata*	Z9	0-5	120	150	2	1.5	High	M – Suppressed	N	N	20-40	M	N
T 149	*Banksia menziesii*	Z9	5-10	170/170	260	2.88	1.88	Mod	M – Twin Stem	N	N	10-20	M	N
T 150	*Eucalyptus marginata*	Z9	10-15	700	700	8.4	2.85	High	G	N	N	40-100	H	N
T 151	*Banksia menziesii*	Z9	0-5	210	330	2.19	2.08	Mod	G	N	N	0-10	L	N
T 152	*Banksia menziesii*	Z9	0-5	190	220	2.28	1.75	Mod	M	N	N	0-10	L	N
T 153	*Eucalyptus marginata*	Z9	10-15	670/320	840/410	8.88	3.21	High	M – Lightning hit	N	N	40-100	H	N
T 154	*Eucalyptus marginata*	Z9	5-10	270	330	3.24	2.08	Mod	G	N	N	40-100	H	N
T 155	*Banksia menziesii*	Z9	5-10	330	370	3.96	2.18	High	G	N	N	10-20	M	N
T 156	*Banksia menziesii*	Z9	0-5	260	280	3.12	1.94	High	G	N	N	0-10	M	N
T 157	*Eucalyptus marginata*	Z9	0-5	160	190	2	1.65	High	M – 4 Stem	N	N	40-100	H	N
T 158	*Banksia menziesii*	Z9	0-5	140/140	250	2	1.85	High	G	N	N	0-10	M	N
T 159	*Eucalyptus marginata*	Z9	10-15	570	690	6.84	2.83	High	M – Dead Stem	N	N	40-100	H	N
T 160	*Eucalyptus marginata*	Z9	5-10	220/260	380	4.08	2.2	High	G – 2 Stem	N	N	40-100	H	N
T 161	*Eucalyptus marginata*	Z9	5-10	200/230/170	260/280/180	4.2	2.3	High	G – 3 Stem	N	N	40-100	H	N
T 162	*Eucalyptus marginata*	Z9	5-10	260	260	3.12	1.88	High	G	N	N	40-100	H	N

TREE No.	SPECIES	ZONE	HEIGHT (m)	DBH (mm)	DGL (mm)	TPZ (m)	SRZ (m)	VITALITY	STRUCTURAL CONDITION	P/D	WEED SPP.	LIFE EXPECT.	RETENTION VALUE	TRANSPLANT ?
T 163	*Eucalyptus marginata*	Z9	5-10	360	430	4.32	2.32	High	G	N	N	40-100	H	N
T 164	*Eucalyptus marginata*	Z9	10-15	360	440	4.32	2.34	High	G	N	N	40-100	H	N
T 165	*Phoenix canariensis*	Z9	0-5	N/A	N/A	2	1.5	High	G	N	N	40-100	L	N
T 166	*Phoenix canariensis*	Z9	0-5	N/A	N/A	2	1.5	High	G	N	N	40-100	L	N
T 167	*Phoenix canariensis*	Z9	5-10	N/A	N/A	2	1.5	High	G	N	N	40-100	L	N
T 168	*Eucalyptus marginata*	Z9	10-15	390	420	4.48	2.3	High	M – Lean	N	N	40-100	H	N
T 169	*Eucalyptus marginata*	Z9	10-15	370	430	4.44	2.32	High	G	N	N	40-100	H	N
T 170	*Eucalyptus marginata*	Z9	10-15	260/180	340	3.84	2.1	High	G	N	N	40-100	H	N
T 171	*Eucalyptus marginata*	Z9	10-15	300/360/260	350/510	6.48	2.71	High	G – Twin Stem	N	N	40-100	H	N
T 172	*Eucalyptus marginata*	Z9	10-15	410/260	540	5.88	2.55	High	G – Twin Stem	N	N	40-100	H	N
T 173	*Corymbia calophylla*	Z9	5-10	310	370	3.72	2.18	High	G	N	N	40-100	H	N
T 174	*Corymbia calophylla*	Z9	10-15	480	580	5.76	2.63	High	G	N	N	40-100	H	N
T 175	*Eucalyptus marginata*	Z9	10-15	550	620	6.6	2.71	High	G	N	N	40-100	H	N
T 176	*Eucalyptus marginata*	Z9	10-15	290/310	350/360	6	2.47	High	G – Twin Stem	N	N	40-100	H	N
T 177	*Eucalyptus marginata*	Z9	5-10	240/290	430	4.56	2.32	High	G – Twin Stem	N	N	40-100	H	N
T 178	*Eucalyptus marginata*	Z9	10-15	500	540	6	2.55	High	M – stem wound	N	N	40-100	H	N
T 179	*Eucalyptus marginata*	Z9	0-5	260	320	3.12	2.05	High	G	N	N	40-100	H	N
T 180	*Eucalyptus marginata*	Z9	10-15	360	430	4.32	2.32	High	G	N	N	40-100	H	N
T 181	*Eucalyptus marginata*	Z9	10-15	330	390	3.96	2.23	High	G	N	N	40-100	H	N
T 182	*Eucalyptus marginata*	Z9	15-20	650/970/610	1680	15	4.12	High	M – basal decay	Bees	N	40-100	VH	N
T 183	*Eucalyptus marginata*	Z9	5-10	260/240	290/250	4.2	2.2	High	G	N	N	40-100	H	N
T 184	*Eucalyptus marginata*	Z9	5-10	280/170/170	300/180/190	4.44	2.25	High	G	N	N	40-100	H	N
T 185	*Eucalyptus marginata*	Z9	5-10	300	300	3.6	2	High	M – Stem wound	N	N	40-100	H	N
T 186	*Banksia*	Z9	0-5	100	170	2	1.57	High	G	N	N	10-20	H	N
T 187	*Jarrah, Marri, Banksia Group*	Z9	Various	Various	Various	4+	3+	High	G	N	N	Various	VH	N
T 188	*Eucalyptus gomphocephala*	Z10	15-20	430	530	5.16	2.53	High	M- stem wound	N	N	40-100	VH	N
T 189	*Eucalyptus gomphocephala*	Z10	0-5	240	330	2.88	2.08	High	M – Suppressed	N	N	40-100	M	N
T 190	*Eucalyptus gomphocephala*	Z10	20-25	550/770/950	560	15	2.59	High	M- basal wound	Ants	N	40-100	VH	N
T 191	*Eucalyptus gomphocephala*	Z10	20-25	540/430	620/530	8.28	3.04	High	G	N	N	40-100	VH	N
T 192	*Eucalyptus rudis*	Z10	5-10	260	310	3.12	2.02	High	G	N	N	40-100	M	Y
T 193	*Eucalyptus conferruminata*	Z10	5-10	320	330	3.84	2.08	High	M – Root damage	N	N	20-40	M	N
T 194	*Eucalyptus conferruminata*	Z10	5-10	440	330	5.28	2.08	High	M – Root damage	N	N	20-40	M	N
T 195	*Corymbia maculata*	Z10	5-10	130	160	2	1.53	High	G	N	N	20-40	L	Y

4 – DISCUSSION

4.1 The fully cleared site option is always a far simpler way to undertake a development as opposed to working around trees. It does however miss the opportunity to retain many significant, possible remnant and important native and habitat trees. Zone 9 (north-east) and Zone 5 (south-west) retain stands of native trees which would be ideal to retain. Zone 5 contains some individual trees that are rated low which could be removed to open up the areas if need be. Zones 1, 2, 3 and 10 retain some very large individual native and non-native trees of high amenity and ecological value that would surely be missed if they were not retained, most notably the mature Tuarts. Zone 1 also retains the eastern fence line of trees which appear as partially retained in some of the proposed development images. With selective removal and remedial pruning this could present as a significant retained stand of trees.

4.2 Zone 4 retains very little in the way of significance and becomes an immediate area for complete clearance potential. While Zone 3 retains some species listed as high retention value (T 60, T 61), transplant options and removal of many of what are self-sewn spreading species seems the better option especially when a new sump area needs to be considered.

4.3 Zone 7 retains a large amounts of palms which are easily transplanted elsewhere onsite or to reserve or selected areas within the City. They do also retain relatively low amenity and habitat value and as such removal and disposal would not be seen as a significant loss. Onsite transplant costs if considered feasible would be far less that moving the trees elsewhere as they can be lifted and moved with Hiabs, Franna cranes and/or crawler cranes.

4.4 Zone 6 retains some significant specimens of *Ficus hillii* or Hills Fig. The main group of trees (T89, 90, 91, 93) adjacent to the current wash down facility present with average vitality and may be showing the effects of long-term root zone damage and waste material pollution. The larger single specimen (Tree 95) is however one of the more impressive albeit non-native trees on the site and is adjacent to a further mature Jarrah (Tree 96) which would also be of benefit to retain. While transplanting could occur the estimated fees ($35 to $40 K) takes a potentially large slice from the overall budget. Adaption of the site design would potentially be the preferred option to retain this tree. It would necessitate the retention of an undisturbed TPZ for the most part with the potential for some encroachment based on further assessment.

4.5 As noted in the introduction there are many alternatives to developing over and about tree roots which exclude the need for potentially damaging excavation where tree roots are lost and tree health declines. These include but are not limited to;

- No dig path and road ways laid over root zones with permeable final upper trafficable material e.g. porous bitumen, permeable pavers
- Confined cells laid path and roadways
- Water harvest kerbing and storage systems
- Above ground pier supported trafficable systems (e.g. ARBORGRID)

Further information, design details and reference material is available at the following sites;

- https://citygreen.com/products/
- http://www.typargeosynthetics.com/applications/stabilization.html
- http://terram.com/products/geocells/tree-root-protection-geocell.html

Image 4 – no dig pathway installed over tree roots

Image 5 – Geocells pre instalment of trafficable material

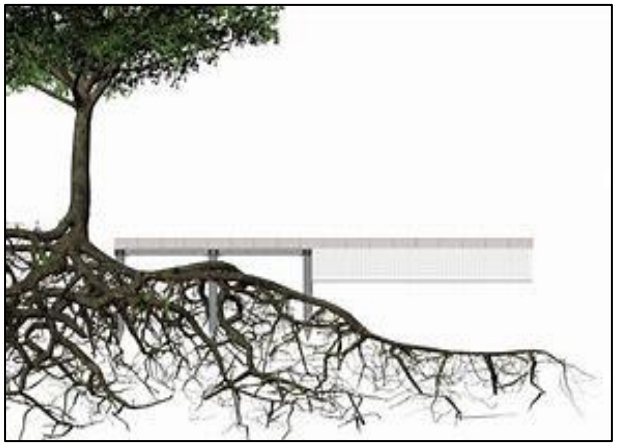


Image 6 - ARBORGRID set over tree roots

Image 7 – installed ARBORGRID

4.6 Other than the clear benefits that trees are not harmed in critical root zone areas, it allows the development into root zones that would be impossible if traditional excavation was undertaken.

4.7 Image 8 (Page 15)outlines what are considered the areas with the highest retention values and provides an opportunity for an assessment of overhead design amendments. It is not the purpose of this report to direct engineering decisions and the real site requirements for refuse recycling remains with the design and approval parties.

4.8 The introduction of pests and disease to development sites is an important consideration. It is pointless retaining trees if a known, harmful pathogen has been introduced and has the potential to result in significant tree decline and death with the site. As daily green waste is delivered unchecked to the site and pathogens can be spread on the wheels of vehicles and feet of employees or visitors, some tests need to be undertaken. It is recommended that soil samples be taken from the two noted native area zones and tests be undertaken to ensure *Phytophthora* is not present. This root borne soil pathogen has the potential to affect all native species other than the Tuarts with rapid decline likely. The City is also advised to consider the installation of entry and exit wheel wash bays which all vehicles pass through when visiting the site.

4.9 Table 1 provides Structural root zone (SRZ) and Tree protection zone (TPZ) areas for each tree on the site. These are areas defined in AS 4970 (2009) – Protection of trees on development sites and are based on the tree's diameter at ground level and breast height respectively. Below is the TPZ and SRZ descriptors from the standard. It is recommended that section 3 from the standard if thoroughly considered before any design considerations are finalised.

3.1 TREE PROTECTION ZONE (TPZ)
The tree protection zone (TPZ) is the principal means of protecting trees on development sites.
The TPZ is a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbance, so that the tree remains viable.

3.3.5 STRUCTURAL ROOT ZONE (SRZ)
The SRZ is the area required for tree stability. A larger area is required to maintain a viable tree.
The SRZ only needs to be calculated when major encroachment into a TPZ is proposed.

Root loss inside the TPZ can result in tree decline and consultation should be undertaken before any work happens in these areas. The standard also lists what cannot happen inside a TPZ during construction, with the main objective being to eliminate root damage from machinery, chemical spill or storage reasons.

The SRZ is critical to tree stability and simply cannot be affected or high failure probabilities may result.

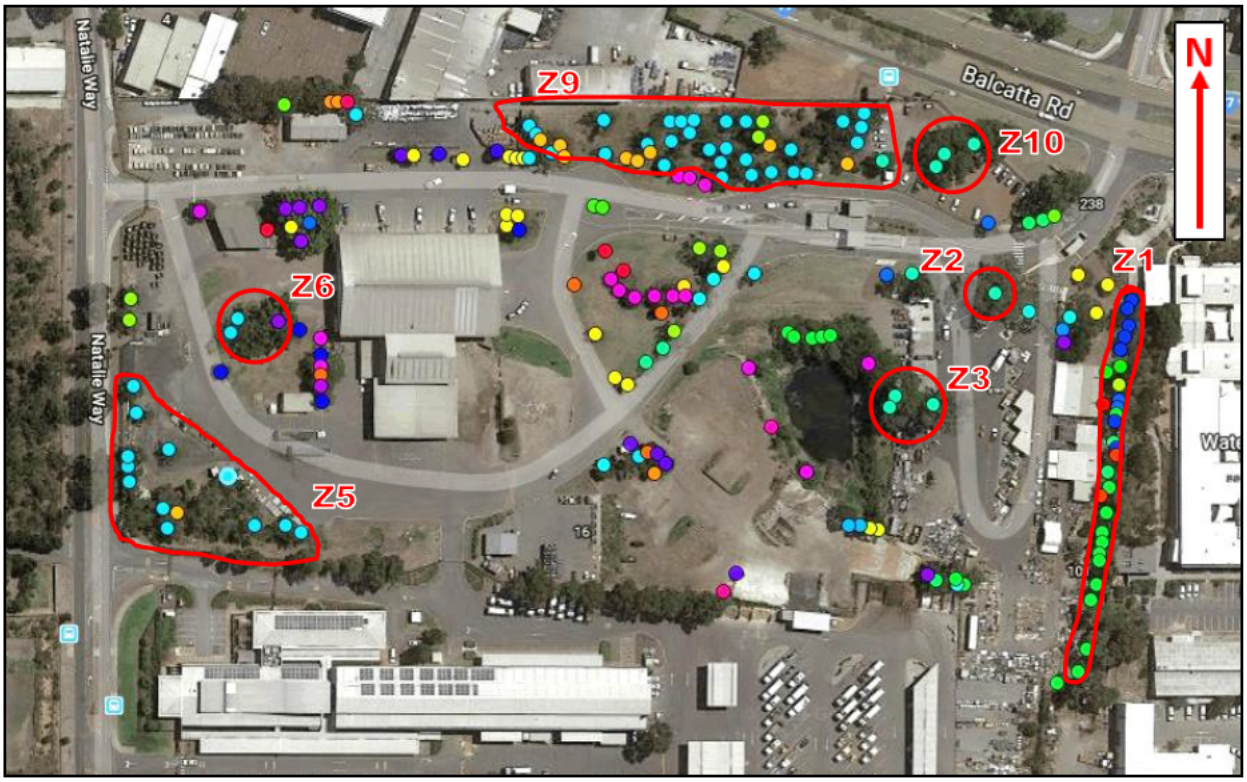


Image 8 – Identified areas with the highest retention value and their corresponding zones.

5 – RECOMMENDATIONS

5.1 Undertake soil samples and testing for *Phytophthora* in the two main native bush zones (Z5 and Z9). The results may have a critical impact on retention decisions and treatment requirements.

5.2 Review the Tree Details tables in conjunction with tree locations and compare against the design requirements to see where sensible amendments may be made to accommodate tree retention.

5.3 In conjunction with 5.2, review the alternative build options for setting new hardstand areas around trees.

5.4 Consider the transplant potential of trees noted for such, where they may be shifted on the site or other sites outside of the refuse centre.

5.5 Where tree retention is proposed have the new design proposal reviewed for confirmation that it is arboriculturally acceptable.

5.6 Where larger trees are proposed for retention, undertake remedial canopy work usually to remove larger deadwood and on occasion reduction of any distal load concerns.

5.7 Consider the option of installing entry and departure wheel wash facilities

Jack Payne - Tom Smith - Steve Kneebone

March 2019

APPENDICIES - TREE IMAGES

TREE 001

TREE 002

TREE 003

TREE 004

TREE 005

TREE 006

TREE 007

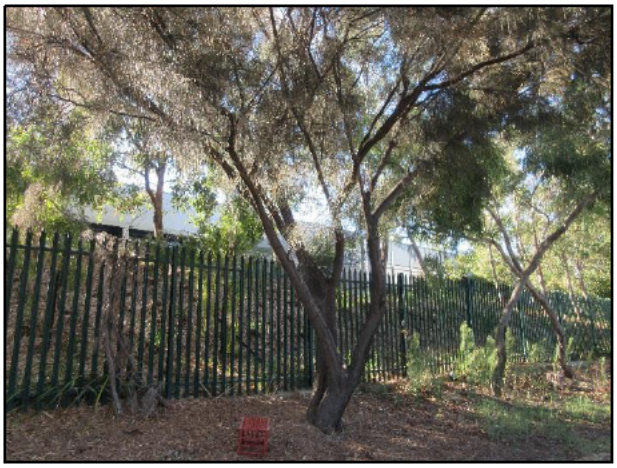
TREE 008

TREE 009

TREE 010

TREE 011

TREE 012



TREE 013

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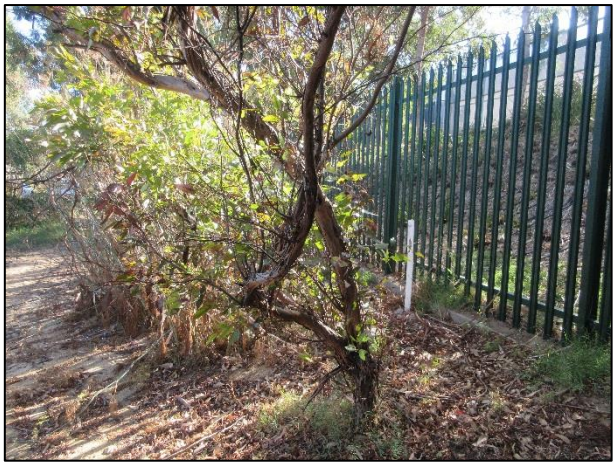
TREE 015

TREE 016

TREE 017

TREE 018

TREE 019



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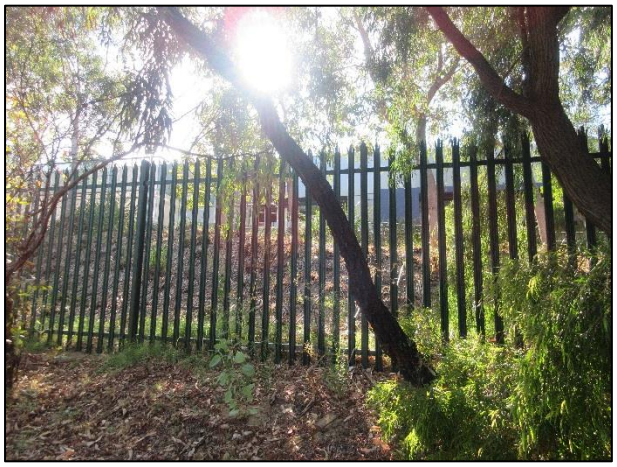

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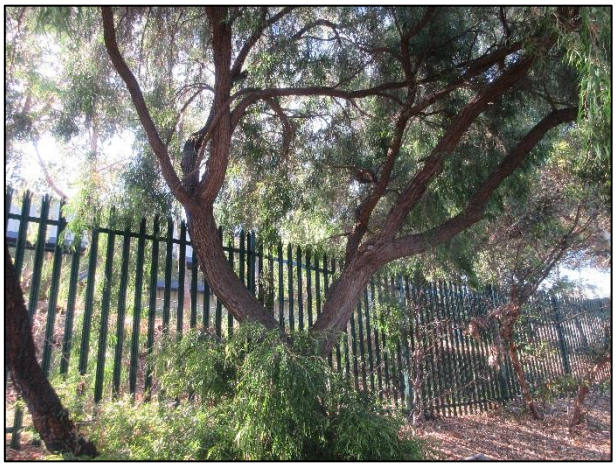

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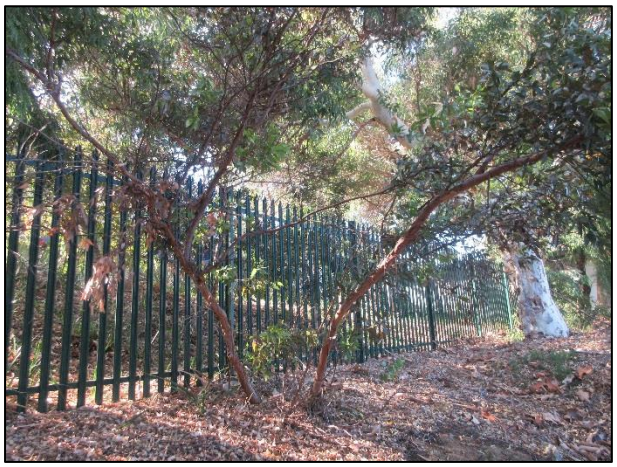

TREE 023

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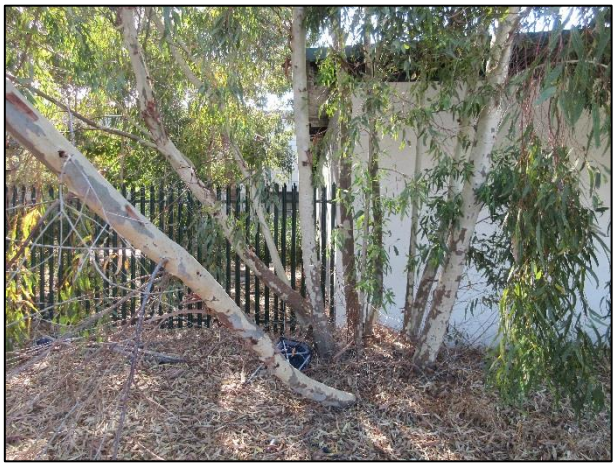
TREE 027



TREE 028

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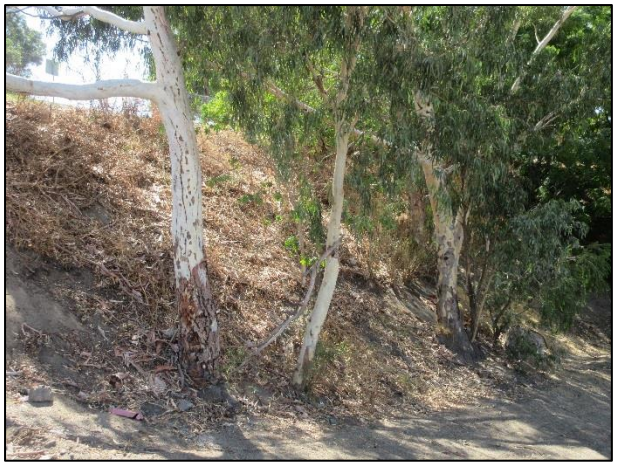

TREE 055

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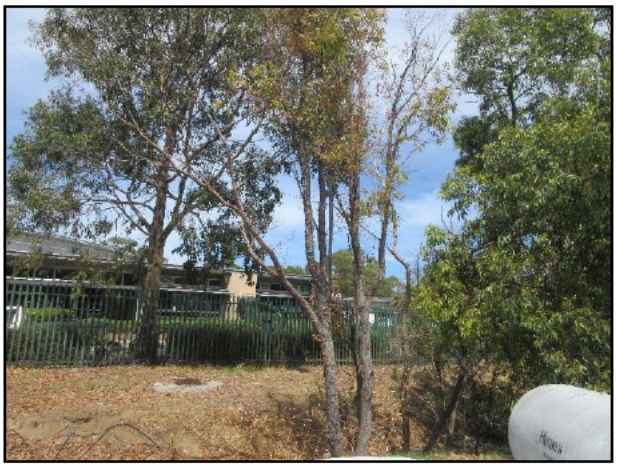

TREE 071

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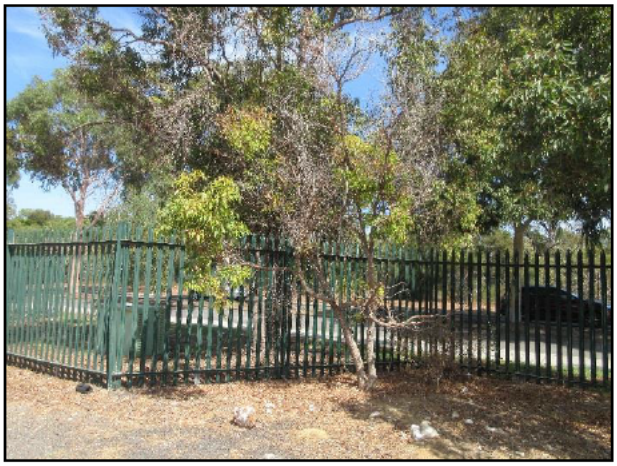

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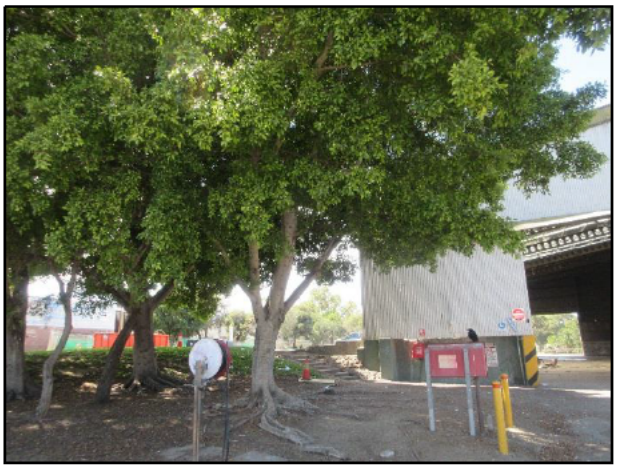

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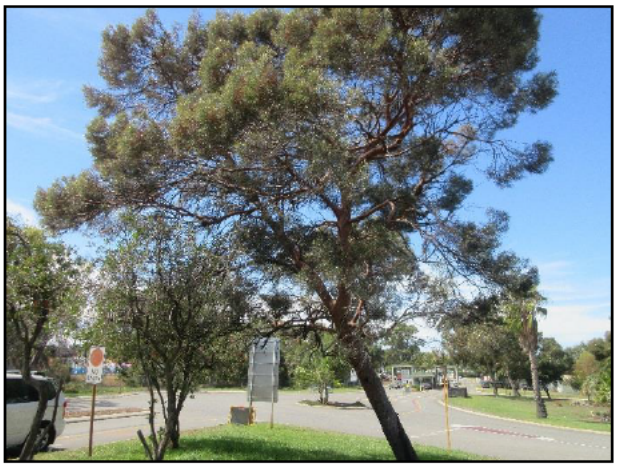
TREE 107



TREE 108

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TREE 111

TREE 112

TREE 113

TREE 114

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