

15. LIST OF APPENDICES

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Appendix 1BN: Proposed Site Plan North

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Appendix 1C: Tree Protection Plan

Appendix 2: Tree Inspection Schedule

Appendix 3: Further information of methodology

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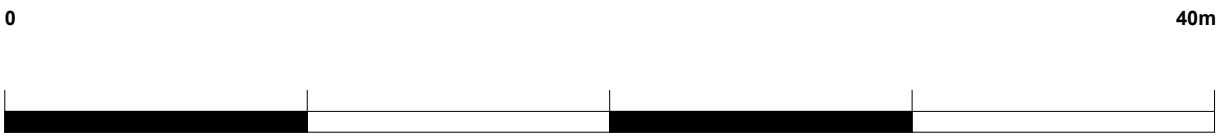
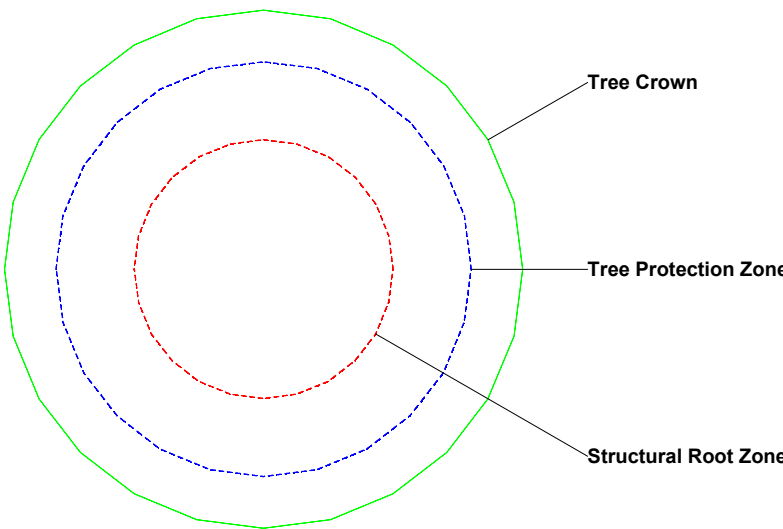


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Appendix 1A: Existing Site Plan Parramatta West Public School

SCALE :
1 : 250

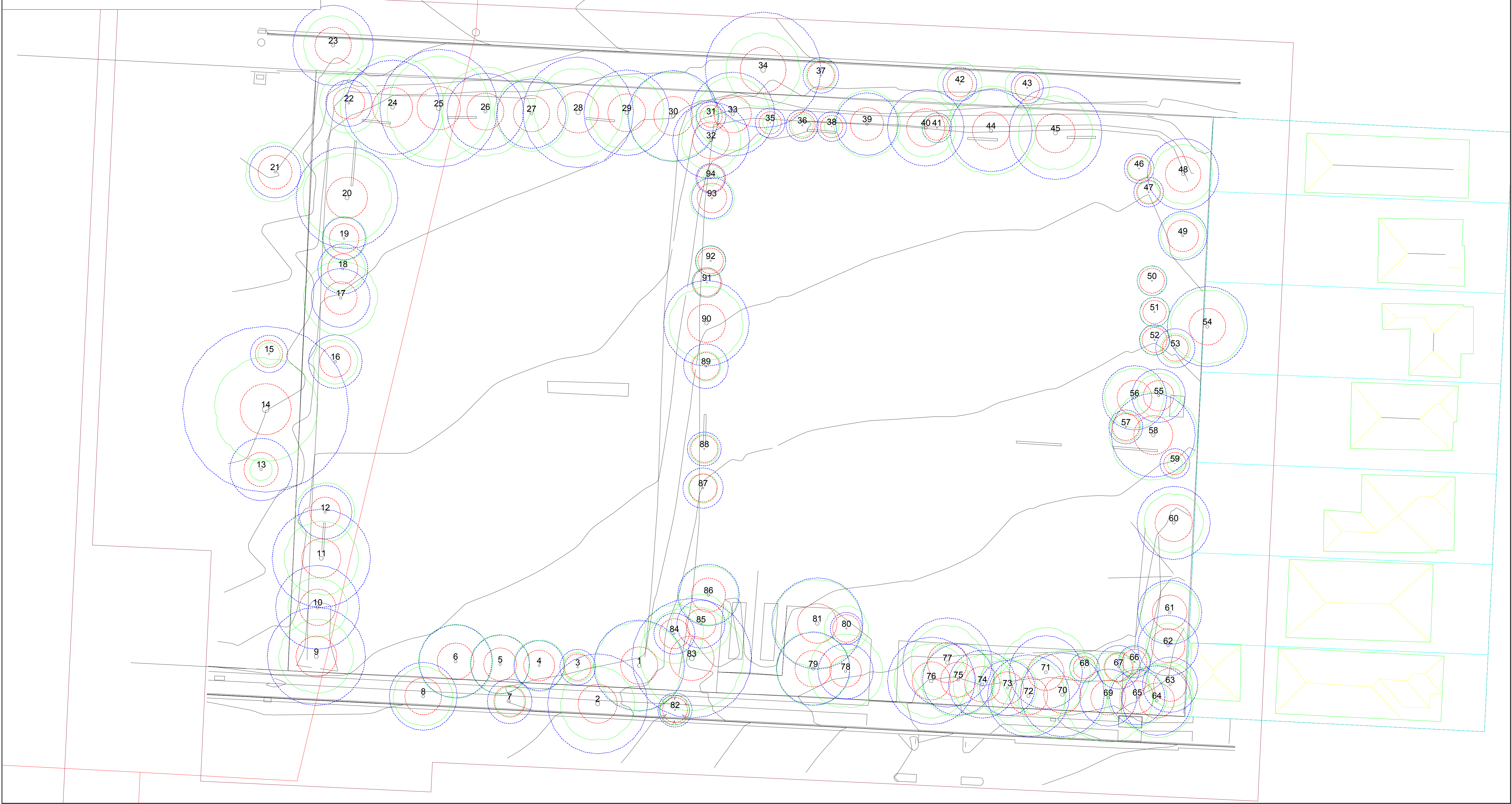
@ A1

DATE :
6/22/2018

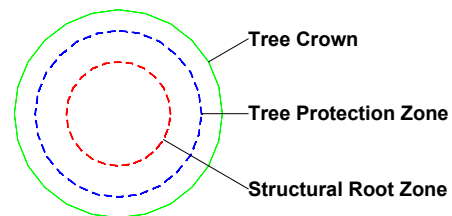


Ref: 18/06/21/PWPS1A

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Map Legend



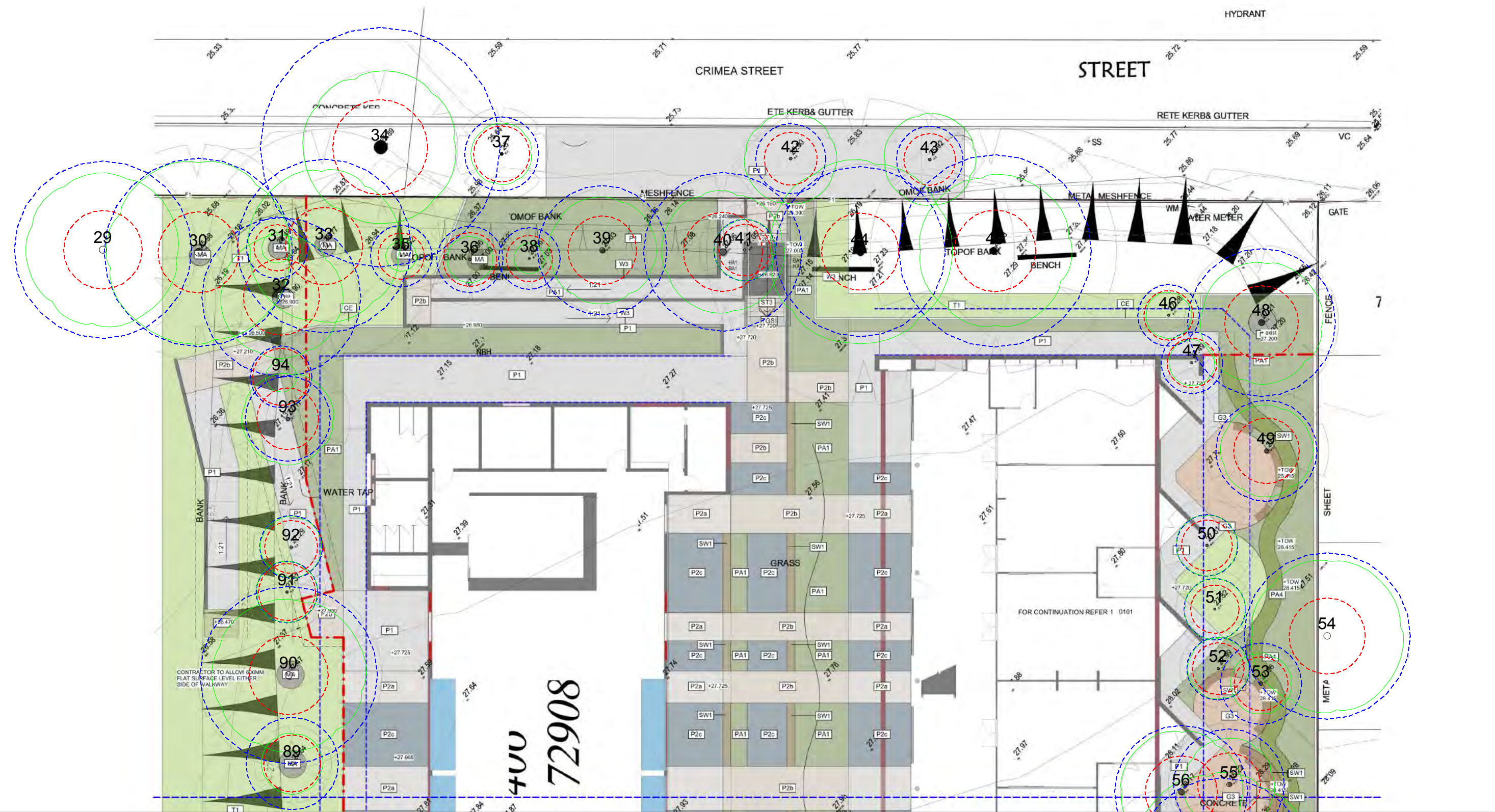
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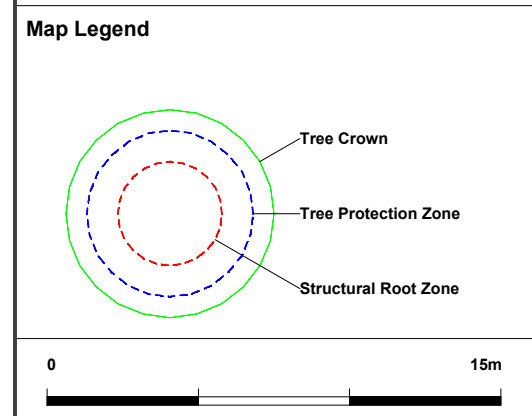
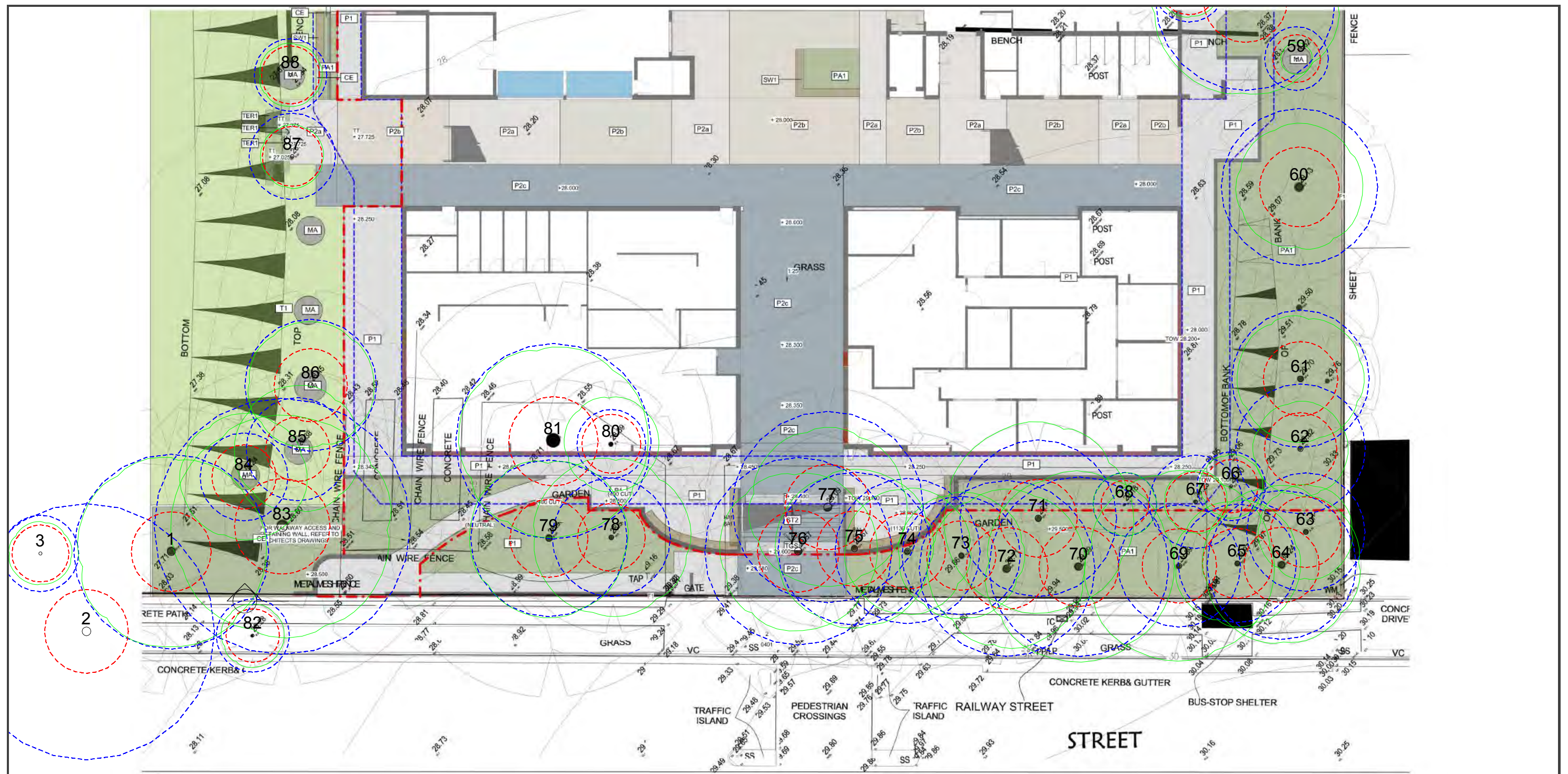
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Appendix 1B-North: Proposed Site Plan
Parramatta West Public School

SCALE : 1 : 250	@ A3	DATE : 6/22/2018	URBAN ARBOR The Foundation is the Difference
Ref: 18/06/21/PWPS1B-N			

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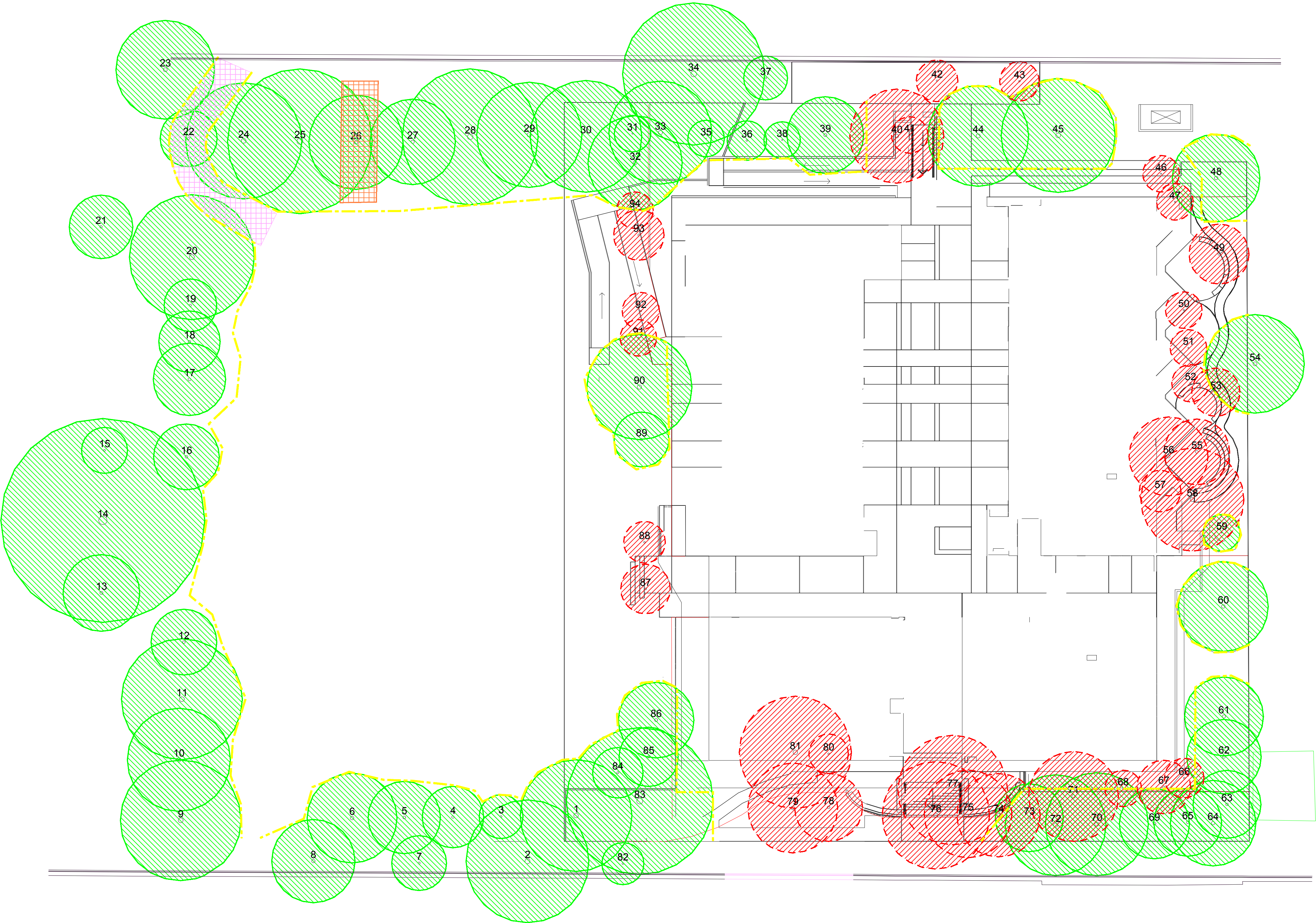
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Appendix 1B-South: Proposed Site Plan
Parramatta West Public School

SCALE : 1 : 250 @ A3	DATE : 6/22/2018
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Ref: 18/06/21/PWPS1B-S

Prepared by: Jack Williams, Urban Arbor Pty Ltd



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Appendix 1C: Tree Protection Plan - Parramatta West Public School

SCALE : 1 : 250 @ A1 DATE : 21/6/2018



Ref: 18/06/21/PWPS1C

Prepared by: Jack Williams, Urban Arbor Pty Ltd

Map Legend

- TPZ tree to be retained
- TPZ tree to be removed
- Preferred Vehicle Access Road
- Alternative Vehicle Access Road
- TPZ Fencing

Appendix 2 - Tree Inspection Schedule

Tree ID	Common Name	Botanical Name	Age Class	Height (m)	Canopy Spread Radius (m)	Stem 1	Stem 2	Stem 3	DBH (mm)	DAB (mm)	Health	Structure	Amenity Value	SULE	Retention Value	TPZ Radius (m)	SRZ Radius (m)	Notes
1	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	12	6	510			510	520	Good	Fair	High	2. Medium	A1	6.1	2.5	Co-dominant stems with included bark. Minor deadwood in lower crown.
2	Black Peppermint	<i>Eucalyptus nicholii</i>	Mature	11	5	560			560	580	Good	Fair	High	2. Medium	A2	6.7	2.6	Located on nature strip. Fungal bracket (Phellinus spp) visible at 5m. Decay testing recommended in this location to determine viability of tree.
3	Spotted Gum	<i>Corymbia maculata</i>	Semi-mature	12	2	200			200	230	Good	Good	Medium	1. Long	A1	2.4	1.8	None.
4	Spotted Gum	<i>Corymbia maculata</i>	Mature	14	3.5	280			280	330	Good	Good	Medium	2. Medium	A1	3.4	2.1	None.
5	Spotted Gum	<i>Corymbia maculata</i>	Mature	15	4	330			330	380	Good	Good	Medium	2. Medium	A1	4.0	2.2	None.
6	Spotted Gum	<i>Corymbia maculata</i>	Mature	15	5	410			410	500	Good	Fair	Medium	2. Medium	A2	4.9	2.5	Co-dominant stems with included bark, possible to remove smaller stem without significantly impacting tree.
7	Sweetgum	<i>Liquidamber styraciflua</i>	Semi-mature	6	2	250			250	350	Fair	Poor	Low	1. Long	Z5	3.0	2.1	Located on nature strip. Significant cavity at base of trunk.
8	Sweetgum	<i>Liquidamber styraciflua</i>	Mature	8	4	380			380	500	Fair	Fair	Medium	3. Short	Z9	4.6	2.5	Located on nature strip. Small cavity at base of trunk.
9	Tallowood	<i>Eucalyptus microcorys</i>	Mature	13	5	550			550	640	Good	Good	High	4. Remove	A1	6.6	2.7	None.
10	Black Peppermint	<i>Eucalyptus nicholii</i>	Mature	10	4	470			470	490	Fair	Fair	Medium	2. Medium	Z9	5.6	2.5	Three visible branch failures at 5m. Low foliage density for species.
11	Hard Leaved Scribbly Gum	<i>Eucalyptus racemosa</i>	Mature	12	5	390	390		552	580	Good	Fair	High	2. Medium	A1	6.6	2.6	Co-dominant stems with minor bark inclusion.
12	Spotted Gum	<i>Corymbia maculata</i>	Mature	13	4	300			300	320	Good	Good	Medium	3. Short	A1	3.6	2.1	None.
13	Willow Myrtle	<i>Agonis flexuosa</i>	Semi-mature	4.5	1.5	350			350	420	Fair	Fair	Low	2. Medium	Z4	4.2	2.3	Located in adjoining council reserve. Low foliage density for species. cavity at 1m. Apical die back, in decline.
14	Argyle Apple	<i>Eucalyptus cinerea</i>	Mature	12	7	930			930	1100	Good	Fair	High	2. Medium	A2	11.2	3.4	Located in adjoining council reserve. Significant lean. Monitoring of lean recommended.
15	Willow Myrtle	<i>Agonis flexuosa</i>	Semi-mature	4	1.5	210			210	250	Fair	Fair	Low	5. Small/Young	Z1	2.5	1.8	Located in adjoining council reserve. Supressed by adjacent tree. cambium damage at 1.5m.
16	Spotted Gum	<i>Corymbia maculata</i>	Mature	15	3	300			300	340	Good	Good	Medium	1. Long	A1	3.6	2.1	None.
17	Narrow Leaved Ironbark	<i>Eucalyptus creba</i>	Mature	11	5	330			330	370	Good	Good	Medium	2. Medium	A1	4.0	2.2	Minor deadwood through crown.
18	Spotted Gum	<i>Corymbia maculata</i>	Mature	13	3	280			280	310	Good	Good	Medium	2. Medium	A1	3.4	2.0	None.
19	Spotted Gum	<i>Corymbia maculata</i>	Mature	13	3	240			240	300	Good	Good	Medium	1. Long	A1	2.9	2.0	Co dominant stems at 9m with relatively good form to union.
20	Black Peppermint	<i>Eucalyptus nicholii</i>	Mature	12	6	570			570	650	Good	Fair	High	1. Long	A1	6.8	2.8	Leaning and asymmetric crown shape.
21	Weeping Bottlebrush	<i>Callistemon viminalis</i>	Mature	7	4	290			290	410	Good	Good	Medium	2. Medium	A1	3.5	2.3	Located in adjoining council reserve.
22	Eucalypt	<i>Eucalyptus spp</i>	Mature	6	4	260			260	350	Fair	Fair	Low	4. Remove	Z10	3.1	2.1	Asymmetric crown shape. Deadwood through lower crown.
23	Black Peppermint	<i>Eucalyptus nicholii</i>	Mature	9	4	450			450	490	Fair	Fair	Medium	2. Medium	A2	5.4	2.5	Located on nature strip. Co-dominant stems with relatively good form to union. Deadwood in lower crown.
24	Tallowood	<i>Eucalyptus microcorys</i>	Mature	14	7	530			530	610	Good	Fair	High	2. Medium	A1	6.4	2.7	Loss of central leader at 8m.
25	Tallowood	<i>Eucalyptus microcorys</i>	Mature	15	7	660			660	740	Good	Fair	High	2. Medium	A2	7.9	2.9	Co-dominant stems with significant bark inclusion.
26	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	12	6	430			430	510	Good	Fair	High	2. Medium	A1	5.2	2.5	Asymmetric crown shape caused by adjacent tree. Minor lean.
27	Tallowood	<i>Eucalyptus microcorys</i>	Mature	14	5	360	150		390	490	Good	Good	High	2. Medium	A1	4.7	2.5	None.
28	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	13	6	620			620	660	Fair	Good	High	2. Medium	A2	7.4	2.8	Minor apical die back. Low foliage density for species. Future monitoring recommended.
29	Tallowood	<i>Eucalyptus microcorys</i>	Mature	14	5	480			480	540	Good	Good	High	2. Medium	A1	5.8	2.6	None.
30	Tallowood	<i>Eucalyptus microcorys</i>	Mature	14	6	510			510	580	Good	Good	High	2. Medium	A1	6.1	2.6	Minor deadwood through crown.
31	Spotted Gum	<i>Corymbia maculata</i>	Dead	8	1	140			140	150	Dead	Poor	Low	4. Remove	Z24	2.0	1.5	Dead tree.
32	Spotted Gum	<i>Corymbia maculata</i>	Mature	17	4	430			430	500	Good	Fair	High	1. Long	A1	5.2	2.5	Co-dominant stems with relatively good form to union.
33	Eucalypt	<i>Eucalyptus spp</i>	Mature	12	5	470			470	520	Poor	Poor	Medium	4. Remove	Z24	5.6	2.5	Advanced stages of decline.
34	Camphor Laurel	<i>Cinnamomum camphora</i>	Mature	8	5	450	330	330	648	850	Fair	Fair	Medium	3. Short	Z4	7.8	3.1	Low foliage density for species. Early stages of decline. Multi stemmed tree.

Appendix 2 - Tree Inspection Schedule

Tree ID	Common Name	Botanical Name	Age Class	Height (m)	Canopy Spread Radius (m)	Stem 1	Stem 2	Stem 3	DBH (mm)	DAB (mm)	Health	Structure	Amenity Value	SULE	Retention Value	TPZ Radius (m)	SRZ Radius (m)	Notes
35	Queensland Brushbox	<i>Lophostemon confertus</i>	Young	5	1	100			100	120	Fair	Fair	Low	5. Small/Young	Z1	2.0	1.5	Located on nature strip. Loss of central leader at 2m. Low foliage density for species.
36	Queensland Brushbox	<i>Lophostemon confertus</i>	Semi-mature	7	1.5	180			180	220	Good	Good	Medium	1. Long	A1	2.2	1.8	None.
37	Lemon Scented Gum	<i>Corymbia citriodora</i>	Semi-mature	13	2	200			200	240	Good	Fair	Medium	2. Medium	A1	2.4	1.8	Located on nature strip. Curve in trunk at 5m.
38	Queensland Brushbox	<i>Lophostemon confertus</i>	Young	6	1	110			110	130	Good	Fair	Low	5. Small/Young	Z1	2.0	1.5	Co-dominant stems at 2m.
39	Narrow Leaved Ironbark	<i>Eucalyptus creba</i>	Mature	13	4.5	350			350	390	Fair	Good	Medium	2. Medium	A2	4.2	2.2	Low foliage density for species with minor apical die back. Future monitoring recommended.
40	Eucalypt	<i>Eucalyptus spp</i>	Mature	12	4	280	240	220	429	550	Fair	Poor	Medium	3. Short	Z5	5.2	2.6	Multi stemmed tree with central stem dead. low foliage density for species.
41	Spotted Gum	<i>Corymbia maculata</i>	Semi-mature	9	2	160			160	200	Poor	Fair	Low	3. Short	Z4	2.0	1.7	Apical die back, in decline.
42	Lemon Scented Gum	<i>Corymbia citriodora</i>	Semi-mature	12	3	190			190	210	Good	Fair	Medium	2. Medium	A1	2.3	1.7	Co-dominant stems at 9m.
43	Lemon Scented Gum	<i>Corymbia citriodora</i>	Semi-mature	8	3	180			180	200	Good	Good	Medium	1. Long	A1	2.2	1.7	Asymetric crown shape caused by adjacent tree.
44	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	12	6	460			460	520	Good	Good	High	1. Long	A2	5.5	2.5	Deadwood in lower crown 100mm in diameter. Deadwood recommended for removal.
45	Eucalypt	<i>Eucalyptus spp</i>	Mature	12	5	520			520	590	Fair	Fair	High	3. Short	Z4	6.2	2.7	Low foliage density for species, early stages of decline.
46	Queensland Brushbox	<i>Lophostemon confertus</i>	Semi-mature	6	1.5	150			150	180	Fair	Good	Low	5. Small/Young	Z1	2.0	1.6	Low foliage density for species.
47	Queensland Brushbox	<i>Lophostemon confertus</i>	Semi-mature	6	1.5	150			150	180	Fair	Good	Low	5. Small/Young	Z1	2.0	1.6	Low foliage density for species.
48	Silky Oak	<i>Grevillea robusta</i>	Mature	13	4	400			400	460	Good	Fair	Medium	2. Medium	A1	4.8	2.4	Co-dominant stems at 5m with minor bark inclusion.
49	Box Elder	<i>Acer negundo</i>	Semi-mature	5	3	150	110	200	273	350	Good	Fair	Low	2. Medium	Z3	3.3	2.1	Exempt species. Multi stemmed tree.
50	Queensland Brushbox	<i>Lophostemon confertus</i>	Semi-mature	6	2	160			160	190	Good	Good	Low	5. Small/Young	Z1	2.0	1.6	None.
51	Queensland Brushbox	<i>Lophostemon confertus</i>	Semi-mature	6	2	140			140	170	Good	Poor	Low	3. Short	Z5	2.0	1.6	Loss of central leader with active split down stem.
52	Queensland Brushbox	<i>Lophostemon confertus</i>	Semi-mature	6	2	170			170	200	Good	Poor	Low	4. Remove	Z25	2.0	1.7	Co dominant stems with active split.
53	Box Elder	<i>Acer negundo</i>	Semi-mature	4	2	220			220	220	Fair	Fair	Low	3. Short	Z3	2.6	1.8	Exempt species. Low foliage density for species. Loss of cambium up central stem.
54	Ash 'Raywood'	<i>Fraxinus raywood</i>	Mature	9	5	450			450	500	Good	Fair	Medium	2. Medium	A1	5.4	2.5	Located in adjoining property. Lateral crack identified on stem within site.
55	River She Oak	<i>Casuarina cunninghamiana</i>	Mature	10	3	300			300	320	Good	Fair	Medium	2. Medium	A1	3.6	2.1	Co-dominant stems with minor bark inclusion. Asymetric crown shape caused by adjacent tree.
56	River She Oak	<i>Casuarina cunninghamiana</i>	Mature	12	4	360			360	440	Good	Fair	Medium	2. Medium	A1	4.3	2.3	Co-dominant stems at 4m with minor bark inclusion.
57	River She Oak	<i>Casuarina cunninghamiana</i>	Semi-mature	9	2	190			190	240	Good	Fair	Low	2. Medium	A1	2.3	1.8	Asymetric crown shape caused by adjacent tree.
58	River She Oak	<i>Casuarina cunninghamiana</i>	Mature	13	6	470			470	580	Good	Good	High	1. Long	A1	5.6	2.6	None.
59	River She Oak	<i>Casuarina cunninghamiana</i>	Young	5	1	80			80	100	Good	Fair	Low	5. Small/Young	Z1	2.0	1.5	Co-dominant stems at 1m.
60	River She Oak	<i>Casuarina cunninghamiana</i>	Mature	12	4	410			410	520	Good	Fair	Medium	2. Medium	A1	4.9	2.5	Previously lopped adjacent to adjoining property. Significant amount of Mistletoe (Amyema spp.) through crown.
61	Swamp Oak	<i>Casuarina glauca</i>	Mature	10	4	360			360	440	Fair	Fair	Medium	2. Medium	A1	4.3	2.3	Low foliage density for species. Previously lopped adjacent to adjoining property.
62	Swamp Oak	<i>Casuarina glauca</i>	Mature	10	3	340			340	410	Good	Fair	Medium	2. Medium	A1	4.1	2.3	Co-dominant stems at 3m.
63	Swamp Oak	<i>Casuarina glauca</i>	Mature	10	3	310			310	390	Good	Fair	Medium	2. Medium	A1	3.7	2.2	Co-dominant stems at 7m.
64	Narrow Leaved Ironbark	<i>Eucalyptus creba</i>	Mature	13	5	390			390	450	Good	Good	High	1. Long	A1	4.7	2.4	None.
65	Narrow Leaved Ironbark	<i>Eucalyptus creba</i>	Mature	14	4	310			310	380	Good	Fair	High	2. Medium	A1	3.7	2.2	Asymetric crown shape.
66	Broad Leaved Paperbark	<i>Melaleuca quinquenervia</i>	Young	6	2	180			180	200	Good	Fair	Low	5. Small/Young	Z1	2.2	1.7	Supressed by adjacent trees.
67	White Cedar	<i>Melia azedarach</i>	Semi-mature	5	2	140	200		244	260	Good	Poor	Low	3. Short	Z5	2.9	1.9	Co-dominant stems with significant bark inclusion.
68	White Cedar	<i>Melia azedarach</i>	Young	4	2	110			110	150	Good	Poor	Low	5. Small/Young	Z1	2.0	1.5	Co-dominant stems rubbing.

Appendix 2 - Tree Inspection Schedule

Tree ID	Common Name	Botanical Name	Age Class	Height (m)	Canopy Spread Radius (m)	Stem 1	Stem 2	Stem 3	DBH (mm)	DAB (mm)	Health	Structure	Amenity Value	SULE	Retention Value	TPZ Radius (m)	SRZ Radius (m)	Notes
69	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	14	6	320			320	440	Good	Fair	High	1. Long	A1	3.8	2.3	Co-dominant stems at 4m with relatively good form to union.
70	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	14	6	470			470	520	Good	Fair	High	1. Long	A1	5.6	2.5	Co-dominant stems with relatively good form to union at 4m.
71	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	14	6	410			410	490	Good	Fair	High	2. Medium	A2	4.9	2.5	Loss of second stem, could not assess cavity. Asymetric crown shape. Further investigation on cavity recommended.
72	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	14	5	460			460	550	Good	Good	High	1. Long	A1	5.5	2.6	Leans slightly towards road.
73	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	12	4	310			310	370	Good	Fair	High	2. Medium	A1	3.7	2.2	Significant curve in trunk at 8m.
74	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	12	4	380			380	460	Good	Fair	High	2. Medium	A2	4.6	2.4	Tree leans significantly. Monitoring of lean recommended.
75	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	13	5	400			400	450	Fair	Good	High	2. Medium	A2	4.8	2.4	Low foliage density for species. Monitoring of tree health recommended.
76	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	14	5	490			490	550	Good	Good	High	1. Long	A1	5.9	2.6	Minor curve in trunk at 7m.
77	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Mature	14	5	500			500	610	Good	Poor	High	3. Short	Z5	6.0	2.7	Co-dominant stems with significant bark inclusion. Tree would not remain viable if single stem removed.
78	Spotted Gum	<i>Corymbia maculata</i>	Mature	10	5	310			310	350	Good	Fair	Medium	2. Medium	A1	3.7	2.1	Asymetric crown shape. moderate foliage density for species.
79	Spotted Gum	<i>Corymbia maculata</i>	Mature	13	5	410			410	490	Good	Good	High	1. Long	A1	4.9	2.5	Co-dominant stems with relatively good form to union.
80	Red Ironbark	<i>Eucalyptus sideroxylon</i>	Semi-mature	4	3	180			180	250	Good	Fair	Low	5. Small/Young	Z1	2.2	1.8	Asymetric crown shape caused by adjacent tree. Leans.
81	Tallowood	<i>Eucalyptus microcorys</i>	Mature	13	6	320	400		512	680	Good	Fair	Medium	2. Medium	A1	6.1	2.8	Co-dominant stems with rubbing.
82	Weeping Bottlebrush	<i>Callistemon viminalis</i>	Mature	5	2	120	150		192	200	Fair	Fair	Low	5. Small/Young	Z1	2.3	1.7	Low foliage density for species. Co-dominant stems with loss of cambium internally on one stem.
83	Spotted Gum	<i>Corymbia maculata</i>	Mature	14	7	670			670	790	Good	Good	High	1. Long	A2	8.0	3.0	Deadwood to 100mm diameter through crown. Deadwood recommended for removal.
84	Eucalypt	<i>Eucalyptus spp</i>	Mature	8	4	230			230	310	Good	Fair	Medium	2. Medium	A1	2.8	2.0	Asymetric crown shape caused by adjacent tree. Leans.
85	Tallowood	<i>Eucalyptus microcorys</i>	Semi-mature	9	4	270			270	310	Good	Fair	Medium	2. Medium	A1	3.2	2.0	Supressed by adjacent tree.
86	Tallowood	<i>Eucalyptus microcorys</i>	Semi-mature	9	4	170	300		345	420	Good	Fair	Medium	1. Long	A1	4.1	2.3	Asymetric crown shape caused by adjacent tree.
87	Queensland Brushbox	<i>Lophostemon confertus</i>	Semi-mature	6	2	160	160		226	260	Good	Good	Medium	1. Long	A1	2.7	1.9	Minor cambium damage at 1.5m.
88	Queensland Brushbox	<i>Lophostemon confertus</i>	Semi-mature	6	2	190			190	240	Good	Fair	Medium	3. Short	Z9	2.3	1.8	Loss of central leader at 2m.
89	Water Gum	<i>Tristaniaopsis laurina</i>	Semi-mature	3.5	2	250			250	250	Good	Fair	Low	5. Small/Young	Z1	3.0	1.8	Multi stemmed tree.
90	Cadagi	<i>Corymbia torelliana</i>	Mature	9	5	480			480	550	Good	Fair	Medium	2. Medium	A1	5.8	2.6	Minor loss of cambium with longicorn beetle damage. Relatively good response growth.
91	Queensland Brushbox	<i>Lophostemon confertus</i>	Young	4	2	110	100		149	250	Good	Fair	Low	5. Small/Young	Z1	2.0	1.8	Co-dominant stems with indicators of decay at base.
92	Queensland Brushbox	<i>Lophostemon confertus</i>	Young	4.5	2	170			170	210	Good	Fair	Low	5. Small/Young	Z1	2.0	1.7	Co-dominant stems at 1.5m.
93	Spotted Gum	<i>Corymbia maculata</i>	Semi-mature	11	3	230			230	300	Good	Fair	Medium	3. Short	Z9	2.8	2.0	Co-dominant stems with failure of stem leaving large wound.
94	Spotted Gum	<i>Corymbia maculata</i>	Young	7	1	80	80	60	128	250	Good	Fair	Low	5. Small/Young	Z1	2.0	1.8	Multi stemmed tree.

Appendix 2 - Tree Inspection Schedule Explanatory Notes

Explanatory Notes

Tree Common/Botanical Name: Where species is unknown it is indicated with an '*spp*'.

Age Class: Veteran, Mature, Semi mature, Young, Dead.

Diameter at Breast Height (DBH): Individual stem diameters recorded in 'stem' columns. DBH is combined DBH when calculated in accordance with AS4970-2009 definition for multi stemmed trees. Measured with a DBH tape at approximately 1.4m above ground level, or in some cases estimated.

Diameter Above root Buttresses (DAB): The trunk/stem diameter above buttresses for calculating the SRZ. Measured with a diameter tape unless otherwise indicated. If the DBH is estimated, the DAB has also been estimated.

Height: Height from ground level to top of crown. All heights are estimated unless otherwise indicated.

Spread: Radius of crown at widest section. All tree spreads are estimated unless otherwise indicated.

Tree Protection Zone (TPZ): DBH x 12. Measured in radius from the centre of the trunk. Rounded to nearest 0.1m. For monocots, the TPZ is set at 1 metre outside the crown projection.

Structural Root Zone (SRZ): $(DAB \times 50)^{0.42} \times 0.64$. Measured in radius from the centre of the trunk. Rounded to nearest 0.1m.

Health: Good, Fair, Poor, Dead.

Structure: Good, Fair, Poor.

Safe Useful Life Expectancy (SULE): 1. Long (40+years), 2. Medium (15 - 40 years), 3. Short (5 - 15 years), 4. Remove (under 5 years), 5. Small/young. See appendices for categories.

Amenity Value: Very High, High, Medium, Low, Very Low.

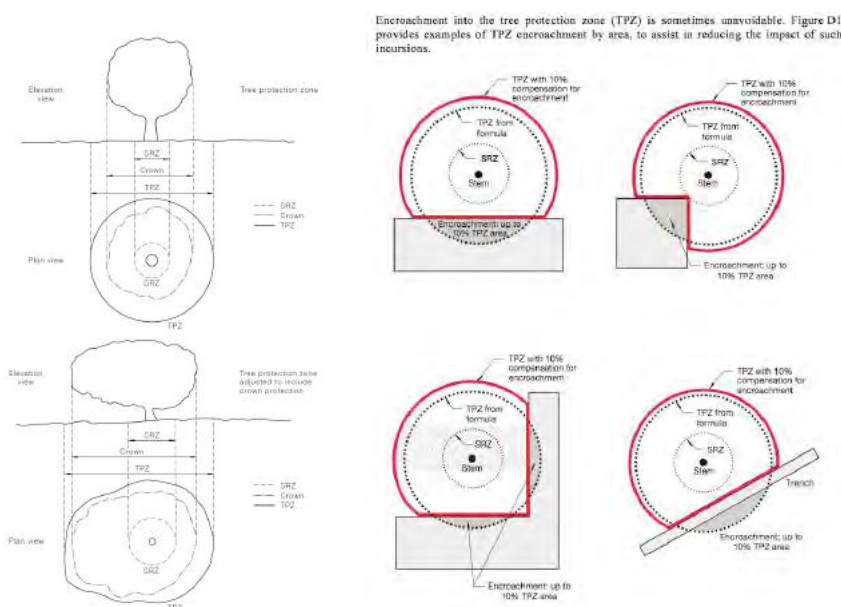
Retention Value: Tree AZ, see appendices for categories.

Appendix 3 - Further Information of Methodology

1. **Tree Protection Zone:** The tree protection zone (TPZ) is the principle 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. The radius of the TPZ is calculated for each tree by multiplying its DBH x 12. The derived value is measured in radius from the centre of the stem/trunk at ground level. A TPZ should not be less than 2.0 metres nor greater than 15 metres (except where crown protection is required). It is commonly observed that tree roots will extend significant further than the indicative TPZ, however the TPZ is an area identified AS4970-2009 to be extent where root loss or disturbance will generally not impact the viability of the tree. The TPZ is identified as a restricted area to prevent damage to trees either above or below ground during a development. Where trees are intended to be retained proposed developments must provide an adequate TPZ around trees. The TPZ is set aside for the tree's root zone, trunk and crown and it is essential for the stability and longevity of the tree. The tree protection also incorporates the SRZ (see below for more information about the SRZ). I have calculated the TPZ of palms, other monocots, cycads and tree ferns at one metre outside the crown projection. See appendices for additional information about the TPZ including information about calculating the TPZ and examples of TPZ encroachment.

Minor encroachment into TPZ: Sometimes encroachment into the TPZ is unavoidable. Encroachment includes but is not limited to activities such as excavation, compacted fill and machine trenching. Minor encroachment of up to 10% of the overall TPZ area is normally considered acceptable, providing there is space adjacent to the TPZ for the tree to compensate and the tree is displaying adequate vigour/health to tolerate changes to its growing environment.

Major encroachment into TPZ: Where encroachment of more than 10% of the overall TPZ area is proposed the project Arborist must investigate and demonstrate that the tree will remain in a viable condition. In some cases, tree sensitive construction methods such as pier and beam footings, suspended slabs, or cantilevered sections, can be utilised to allow additional encroachment into the TPZ by bridging over roots and minimising root disturbance. Major encroachment is only possible if it can be undertaken without severing significant size roots, or if it can be demonstrated that significant roots will not be impacted.



2. **Structural Root Zone:** This is the area around the base of a tree required for the trees stability in the ground. An area larger than the SRZ always need to be maintained to preserve a viable tree as it will only have a minor effect on the trees vigour and health. There are several factors that determine the SRZ which include height, crown area, soil type and soil moisture. It can also be influenced by other factors such as natural or built structures. Generally work within the SRZ should be avoided.

An indicative SRZ radius can be determined from the diameter of the trunk measured immediately above the root buttresses. Root investigation could provide more information about the extent of the SRZ. The following formula should be used to calculate the SRZ.

SRZ radius = $(D \times 50)^{0.42} \times 0.64$ (D = Diameter above root buttress).

3. **Tree Age Class:** If can be difficult to determine the age of a tree without carrying out invasive tests that may damage the tree, so we have categorised there likely age class which is defined below;
 - Young/Newly planted: Young or recently planted tree.
 - Semi Mature: Up to 20% of the usual life expectancy for the species.
 - Early mature/Mature: Between 20%-80% of the usual life expectancy for the species.
 - Over mature: Over 80% of the usual life expectancy for the species.
 - Dead: Tree is dead or almost dead.

4. **Health/Physiological Condition:** Below are examples conditions used when assigning a category for tree health.

<u>Category</u>	<u>Example condition</u>	<u>Summary</u>
Good	• Crown has good foliage density for species. • Tree shows no or minimal signs of pathogens that are unlikely to have an effect on the health of the tree. • Tree is displaying good vigour and reactive growth development.	• The tree is in above average health and condition and no remedial works are required.
Fair	• The tree may be starting to dieback or have over 25% deadwood. • Tree may have slightly reduced crown density or thinning. • There may be some discolouration of foliage. • Average reactive growth development. • There may be early signs of pathogens which may further deteriorate the health of the tree. • There may be epicormic growth indicating increased levels of stress within the tree.	• The tree is in below average health and condition and may require remedial works to improve the trees health.
Poor	• The tree may be in decline, have extensive dieback or have over 30% deadwood. • The canopy may be sparse or the leaves may be unusually small for species. • Pathogens or pests are having a significant detrimental effect on the tree health.	• The tree is displaying low levels of health and removal or remedial works may be required.
Dead	• The tree is dead or almost dead.	• The tree should generally be removed.

5. **Structural Condition:** Below are examples conditions used when assigning a category for structural condition.

<u>Category</u>	<u>Example condition</u>	<u>Summary</u>
Good	• Branch unions appear to be strong with no sign of defects. • There are no significant cavities. • The tree is unlikely to fail in usual conditions. • The tree has a balanced crown shape and form.	• The tree is considered structurally good with well developed form.
Fair	• The tree may have minor structural defects within the structure of the crown that could potentially develop into more significant defects. • The tree may have a cavity that is currently unlikely to fail but may deteriorate in the future. • The tree is an unbalanced shape or leans significantly. • The tree may have minor damage to its roots. • The root plate may have moved in the past but the tree has now compensated for this. • Branches may be rubbing or crossing.	• The identified defects are unlikely cause major failure. • Some branch failure may occur in usual conditions. • Remedial works can be undertaken to alleviate potential defects.
Poor	• The tree has significant structural defects. • Branch unions may be poor or weak. • The tree may have a cavity or cavities with excessive levels of decay that could cause catastrophic failure. • The tree may have root damage or is displaying signs of recent movement. • The tree crown may have poor weight distribution which could cause failure.	• The identified defects are likely to cause either partial or whole failure of the tree.

6. **Amenity Value:** To determine the amenity value of a tree we assess a number of different factors, which include but are not limited to the information below.

- The visibility of the tree to adjacent sites.
- The relationship between the tree and the site.
- Whether the tree is protected by any statutory conditions.
- The habitat value of the tree.
- Whether the tree is considered a noxious weed species.

The amenity value is rated using one of the following values.

- Very High
- High
- Moderate
- Low
- Very Low

7. **Safe Useful Life Expectancy (SULE), (Barrel, 2001):** A tree's safe useful life expectancy is determined by assessing a number of different factors including the health and vitality, estimated age in relation to expected life expectancy for the species, structural defects, and remedial works that could allow retention in the existing situation.

Category	Description
1. Long - Over 40 years	(a) Structurally sound trees located in positions that can accommodate future growth. (b) Trees that could be made suitable for retention in the long term by remedial tree care. (c) Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention.
2. Medium - 15 to 40 years	(a) Trees that may only live between 15 and 40 more years. (b) Trees that could live for more than 40 years but may be removed for safety or nuisance reasons. (c) Trees that could live for more than 40 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (d) Trees that could be made suitable for retention in the medium term by remedial tree care.
3. Short - 5 to 15 years	(a) Trees that may only live between 5 and 15 more years. (b) Trees that could live for more than 15 years but may be removed for safety or nuisance reasons. (c) Trees that could live for more than 15 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (d) Trees that require substantial remedial tree care and are only suitable for retention in the short term.
4. Remove - Under 5 years	(a) Dead, dying, suppressed or declining trees because of disease or inhospitable conditions. (b) Dangerous trees because of instability or recent loss of adjacent trees. (c) Dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form. (d) Damaged trees that are clearly not safe to retain. (e) Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (f) Trees that are damaging or may cause damage to existing structures within 5 years. (g) Trees that will become dangerous after removal of other trees for the reasons given in (a) to (f). (h) Trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review.
5. Small/Young	(a) Small trees less than 5m in height. (b) Young trees less than 15 years old but over 5m in height. (c) Formal hedges and trees intended for regular pruning to artificially control growth.

8. **Root investigations:** The root investigations should identify roots greater than 30mm in diameter that are located along the edge of the structure's footprint or in the location of footings. Root investigations must be carried out using non-invasive methods, such as manual excavations or ground penetrating radar (GPR). Any excavations for the root investigations must be carried out manually to avoid damaging the roots during excavations. Manual excavation may include the use of a high-pressure air/air knife, or a combination of high-pressure water and a vacuum device. When hand excavating carefully work around roots retaining as many as possible. Take care to not fray, wound, or cause damage to any roots during excavations as this may cause decay or infection from pathogens. It is essential that exposed roots are kept moist and the excavation back filled as soon as possible. The root investigations should be carried out by a qualified Arborist minimum AQF3. Once roots are exposed, a visual assessment can be carried out by a consulting Arborist to evaluate the potential impact of the proposed root loss on the health and stability of the tree. A root map/report should be prepared identifying the findings of investigations, including photographs as supporting evidence in the report.

9. **Retention Value:** The system I have used to award the retention value is Tree AZ. Tree AZ is used to identify higher value trees worthy of being a constraint to development and lower value trees that should generally not be a constraint to the development. The table below provides a brief description of each category.

TreeAZ Categories (Version 10.04-ANZ)

CAUTION: TreeAZ assessments must be carried out by a competent person qualified and experienced in arboriculture. The following category descriptions are designed to be a brief field reference and are not intended to be self-explanatory. They must be read in conjunction with the most current explanations published at www.TreeAZ.com.

Category Z: Unimportant trees not worthy of being a material constraint

Local policy exemptions: Trees that are unsuitable for legal protection for local policy reasons including size, proximity and species

- Z1** Young or insignificant small trees, i.e. below the local size threshold for legal protection, etc
- Z2** Too close to a building, i.e. exempt from legal protection because of proximity, etc
- Z3** Species that cannot be protected for other reasons, i.e. scheduled noxious weeds, out of character in a setting of acknowledged importance, etc

High risk of death or failure: Trees that are likely to be removed within 10 years because of acute health issues or severe structural failure

- Z4** Dead, dying, diseased or declining
- Z5** Severe damage and/or structural defects where a high risk of failure cannot be satisfactorily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, overgrown and vulnerable to adverse weather conditions, etc
- Z6** Instability, i.e. poor anchorage, increased exposure, etc
- Z7** **Excessive nuisance:** Trees that are likely to be removed within 10 years because of unacceptable impact on people
- Z8** Excessive, severe and intolerable inconvenience to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. dominance, debris, interference, etc
- Z9** Excessive, severe and intolerable damage to property to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. severe structural damage to surfacing and buildings, etc

Good management: Trees that are likely to be removed within 10 years through responsible management of the tree population

- Z10** Severe damage and/or structural defects where a high risk of failure can be temporarily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, vulnerable to adverse weather conditions, etc
- Z11** Poor condition or location with a low potential for recovery or improvement, i.e. dominated by adjacent trees or buildings, poor architectural framework, etc
- Z12** Removal would benefit better adjacent trees, i.e. relieve physical interference, suppression, etc
- Z13** Unacceptably expensive to retain, i.e. severe defects requiring excessive levels of maintenance, etc

NOTE: Z trees with a high risk of death/failure (Z4, Z5 & Z6) or causing severe inconvenience (Z7 & Z8) at the time of assessment and need an urgent risk assessment can be designated as ZZ. ZZ trees are likely to be unsuitable for retention and at the bottom of the categorization hierarchy. In contrast, although Z trees are not worthy of influencing new designs, urgent removal is not essential and they could be retained in the short term, if appropriate.

Category A: Important trees suitable for retention for more than 10 years and worthy of being a material constraint

- A1** No significant defects and could be retained with minimal remedial care
- A2** Minor defects that could be addressed by remedial care and/or work to adjacent trees
- A3** Special significance for historical, cultural, commemorative or rarity reasons that would warrant extraordinary efforts to retain for more than 10 years
- A4** Trees that may be worthy of legal protection for ecological reasons (Advisory requiring specialist assessment)

NOTE: Category A1 trees that are already large and exceptional, or have the potential to become so with minimal maintenance, can be designated as AA at the discretion of the assessor. Although all A and AA trees are sufficiently important to be material constraints, AA trees are at the top of the categorization hierarchy and should be given the most weight in any selection process.

TreeAZ is designed by Barrell Tree Consultancy (www.barrelltreecare.co.uk) and is reproduced with their permission

Glossary of Terms

Abiotic - Pertaining to non-living agents; e.g. environmental factors

Adventitious shoots - Shoots that develop other than from apical, axillary or dormant buds; see also 'epicormic'

Anchorage - The system whereby a tree is fixed within the soil, involving cohesion between roots and soil and the development of a branched system of roots which withstands wind and gravitational forces transmitted from the aerial parts of the tree

Bark - A term usually applied to all the tissues of a woody plant lying outside the vascular cambium, thus including the phloem, cortex and periderm; occasionally applied only to the periderm or the phellem

Branch:

- **Primary.** A first order branch arising from a stem
- **Lateral.** A second order branch, subordinate to a primary branch or stem and bearing sub-lateral branches
- **Sub-lateral.** A third order branch, subordinate to a lateral or primary branch, or stem and usually bearing only twigs

Branch collar - A visible swelling formed at the base of a branch whose diameter growth has been disproportionately slow compared to that of the parent stem; a term sometimes applied also to the pattern of growth of the cells of the parent stem around the branch base

Brown-rot - A type of wood decay in which cellulose is degraded, while lignin is only modified

Buckling - An irreversible deformation of a structure subjected to a bending load

Buttress zone - The region at the base of a tree where the major lateral roots join the stem, with buttress-like formations on the upper side of the junctions

Cambium - Layer of dividing cells producing xylem (woody) tissue internally and phloem (bark) tissue externally

Canker - A persistent lesion formed by the death of bark and cambium due to colonisation by fungi or bacteria

Compartmentalisation - The confinement of disease, decay or other dysfunction within an anatomically discrete region of plant tissue, due to passive and/or active defences operating at the boundaries of the affected region

Compressive loading - Mechanical loading which exerts a positive pressure; the opposite to tensile loading

Condition - An indication of the physiological condition of the tree. Where the term 'condition' is used in a report, it should not be taken as an indication of the stability of the tree

Crown/Canopy - The main foliage bearing section of the tree

Crown lifting - The removal of limbs and small branches to a specified height above ground level

Crown thinning - The removal of a proportion of secondary branch growth throughout the crown to produce an even density of foliage around a well-balanced branch structure

Crown reduction/shaping - A specified reduction in crown size whilst preserving, as far as possible, the natural tree shape

DAB (Diameter Above Buttress) - Trunk diameter measured above the root buttress

Defect - In relation to tree hazards, any feature of a tree which detracts from the uniform distribution of mechanical stress, or which makes the tree mechanically unsuited to its environment

Dieback - The death of parts of a woody plant, starting at shoot-tips or root-tips

Disease - A malfunction in or destruction of tissues within a living organism, usually excluding mechanical damage; in trees, usually caused by pathogenic micro-organisms

Dominance - In trees, the tendency for a leading shoot to grow faster or more vigorously than the lateral shoots; also the tendency of a tree to maintain a taller crown than its neighbours

Dormant bud - An axial bud which does not develop into a shoot until after the formation of two or more annual wood increments; many such buds persist through the life of a tree and develop only if stimulated to do so

Dysfunction - In woody tissues, the loss of physiological function, especially water conduction, in sapwood

DBH (Diameter at Breast Height) - Stem diameter measured at a height of 1.4 metres or the nearest measurable point. Where measurement at a height of 1.4 metres is not possible, another height may be specified

Deadwood - Branch or stem wood bearing no live tissues. Retention of deadwood provides valuable habitat for a wide range of species and seldom represents a threat to the health of the tree. Removal of deadwood can result in the ingress of decay to otherwise sound tissues and climbing operations to access deadwood can cause significant damage to a tree. Removal of deadwood is generally recommended only where it represents an unacceptable level of hazard

Epicormic shoot - A shoot having developed from a dormant or adventitious bud and not having developed from a first year shoot

Flush-cut - A pruning cut which removes part of the branch bark ridge and or branch-collar

Girdling root - A root which circles and constricts the stem or roots possibly causing death of phloem and/or cambial tissue

Habit - The overall growth characteristics, shape of the tree and branch structure

Hazard beam - An upwardly curved part of a tree in which strong internal stresses may occur without being reduced by adaptive growth; prone to longitudinal splitting

Heartwood/false-heartwood - The dead central wood that has become dysfunctional as part of the aging processes and being distinct from the sapwood

Heave - A term mainly applicable to a shrinkable clay soil which expands due to re-wetting after the felling of a tree which was previously extracting moisture from the deeper layers; also the lifting of pavements and other structures by root diameter expansion; also the lifting of one side of a wind-rocked root-plate

Included bark (ingrown bark) - Bark of adjacent parts of a tree (usually forks, acutely joined branches or basal flutes) which is in face-to-face contact

Lever arm - A mechanical term denoting the length of the lever represented by a structure that is free to move at one end, such as a tree or an individual branch

Lignin - The hard, cement-like constituent of wood cells; deposition of lignin within the matrix of cellulose microfibrils in the cell wall is termed Lignification

Lions tailing - A term applied to a branch of a tree that has few if any side-branches except at its end, and is thus liable to snap due to end-loading

Loading - A mechanical term describing the force acting on a structure from a particular source; e.g. the weight of the structure itself or wind pressure

Mycelium - The body of a fungus, consisting of branched filaments (hyphae)

Occlusion - The process whereby a wound is progressively closed by the formation of new wood and bark around it

Pathogen - A micro-organism which causes disease in another organism

Photosynthesis - The process whereby plants use light energy to split hydrogen from water molecules, and combine it with carbon dioxide to form the molecular building blocks for synthesizing carbohydrates and other biochemical products

Probability - A statistical measure of the likelihood that a particular event might occur

Pruning - The removal or cutting back of twigs or branches, sometimes applied to twigs or small branches only, but often used to describe most activities involving the cutting of trees or shrubs

Radial - In the plane or direction of the radius of a circular object such as a tree stem

Reactive Growth/Reaction Wood - Production of woody tissue in response to altered mechanical loading; often in response to internal defect or decay and associated strength loss (cf. adaptive growth)

Ring-barking - The removal of a ring of bark and phloem around the circumference of a stem or branch, normally resulting in an inability to transport photosynthetic assimilates below the area of damage. Almost inevitably results in the eventual death of the affected stem or branch above the damage

Root-collar - The transitional area between the stem/s and roots

Sapwood - Living xylem tissues

Soft-rot - A kind of wood decay in which a fungus degrades cellulose within the cell walls, without any general degradation of the wall as a whole

Stem/s - Principle above-ground structural component(s) of a tree that supports its branches

Stress - In plant physiology, a condition under which one or more physiological functions are not operating within their optimum range, for example due to lack of water, inadequate nutrition or extremes of temperature

SRZ (Structural Root Zone) - The area around the base of the tree required for the tree's stability in the ground.

Subsidence - In relation to soil or structures resting in or on soil, a sinking due to shrinkage when certain types of clay soil dry out, sometimes due to extraction of moisture by tree roots

Taper - In stems and branches, the degree of change in girth along a given length

Targets - In tree risk assessment (with slight misuse of normal meaning) persons or property or other things of value which might be harmed by mechanical failure of the tree or by objects falling from it

Topping - In arboriculture, the removal of the crown of a tree, or of a major proportion of it

Transpiration - The evaporation of moisture from the surface of a plant, especially via the stomata of leaves; it exerts a suction which draws water up from the roots and through the intervening xylem cells

TPZ (Tree Protection Zone) - A specified area above and below ground and at a given distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development.

Understory - This layer consists of younger individuals of the dominant trees, together with smaller trees and shrubs which are adapted to grow under lower light conditions

Veteran tree - Tree that, by recognised criteria, shows features of biological, cultural or aesthetic value that are characteristic of, but not exclusive to, individuals surviving beyond the typical age range for the species concerned. These characteristics might typically include a large girth, signs of crown retrenchment and hollowing of the stem

Vigour - The expression of carbohydrate expenditure to growth (in trees)

White-rot - A range of kinds of wood decay in which lignin, usually together with cellulose and other wood constituents, is degraded

Wind exposure - The degree to which a tree or other object is exposed to wind, both in terms of duration and velocity

Wind pressure - The force exerted by a wind on a particular object

Windthrow - The blowing over of a tree at its roots