Proposed Visitor Centre
Llanishen & Lisvane Reservoirs, Cardiff
Tree Survey and Arboricultural Impact Assessment

On behalf of:

Dwr Cymru Welsh Water

Based on an inspection
carried out

12th January 2018

By

Wyn Davies CMLI, M.Arbor.A

MACKLEY DAVIES ASSOCIATES LTD
Ffynnon yr Eirin, Crickhowell Road, Gilwern, Abergavenny
NP7 0EH . 01873 831796 . wyn@mackleydavies.co.uk

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Llanishen & Lisvane Reservoirs

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1 Introduction:

1.1 The following report was prepared on the instructions of Charlotte Arnell of Turner & Townsend on behalf of the Dwr Cymru Welsh Water and concerns the area of land adjacent to the Llanishen & Lisvane Reservoirs.

1.2 It is based upon the findings of a tree survey carried out on 12th January 2018 to assess the existing trees in terms of health, condition, form and overall significance within the local environment, the main objective being to assess the degree of constraint it represents with regard to any new development proposals. The methodology used is outlined in Appendix 1, while Appendix 2 sets out definitions of the terms used and codes used in the Tree Schedule.

1.3 Weather conditions were warm & sunny with adequate visibility for the purposes of this investigation. All inspections were made from ground level only: only those features apparent at the time of the inspection could be considered and no liability can be accepted regarding trees or their parts that were inaccessible or obscured in part or in whole.

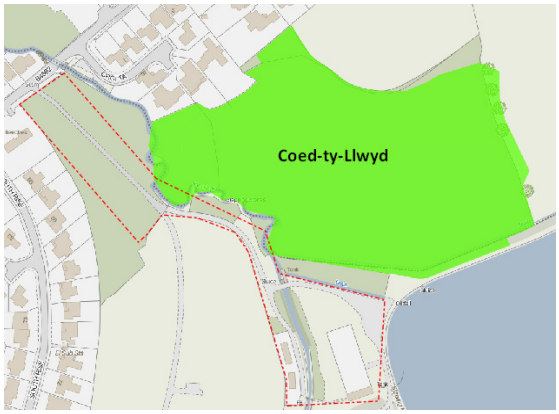
1.4 It should be noted that, although the health and safety of the trees is part of the assessment methodology used, this report is intended for planning purposes only; it should not be construed as a tree risk assessment. Faults may be identified and recorded as part of this study but unless the trees in question represent a significant hazard under the existing site conditions, management recommendations will not normally be made. It remains the tree owner's responsibility to ensure the trees are managed appropriately: the assessor can accept no liability for damage or injury sustained as a result of the failure of any tree or its parts.

2 Inspection and General Observations.

2.1 The survey area is as indicated on the accompanying tree constraints plan. This has been based upon a topographical survey produced by Alpine Land Surveys Ltd (drawing no. ALS/01482 – 003 & 004). The area surveyed includes land within the ownership of Dwr Cymru Welsh Water but also includes the access road which is in the ownership of Cardiff City Council.

2.2 The survey area is immediately adjacent to Coed-ty-Llwyd, an area of Ancient Semi-Natural Woodland which lies to the east of Nant Fawr.

2.3 The woodland areas adjacent to the access drive consist of mature alder/ash woodland, occasional sycamore and wych elm, together with a distinctive group of mature spruce. Towards the south adjacent to the overflow channel there are avenues of mature pine and cherry.



Approximate area of survey (in red)

3 Arboricultural Impact Assessment.

3.1 The tree constraints plan will provide a guide to assist the design of the development proposals, which once detailed should be analysed to assess the degree of impact on the existing tree stock.

3.2 This can then be included as an addendum to further inform the tree report together with recommended measures (protective barriers and ground protection works) to be taken to ensure the protection of any retained trees during the construction process.

3.3 An arboricultural method statement may be required if works are proposed within the root protection areas of any trees to be retained.

4 Existing tree schedule.

The table following overleaf provides details of all the trees surveyed; notes on the terms and abbreviations used can be found at Appendix 2 following the tree schedule.

Details of the Terms & Abbreviations used are provided at Appendix 1 (Note: # denotes estimated stem diameter)

ID	*Species*	Stem No.	Trunk Diam (mm)	Height (m.)	Crown Spread (metres)				Clearance (metres)		Life stage	Health & Vigour	Structural Condition	Remaining useful life	*Observations*	Retention CATEGORY	Protection Radius (m)	RPA (m^2)
					N	E	S	W	Mean	Lowest over site + Direction								
1	Unknown	1	700#	8	0	3	0	0	-	6-E	M	Dead	Poor	<10	Dense ivy, lost main stem	U	8.4	-
2	Ash	1	150	6	1	0.5	1	3	5	-	Y	Good	Good	20-40	Ivy	Cii	1.8	10
3	Ash	1	175	8	1	1	3	1	3	-	Y	Good	Good	20-40	Ivy	Cii	2.1	14
4	Ash	1	250	10	1.5	1.5	2	2.5	4	-	EM	Good	Good	20-40	Ivy	Cii	3.0	28
5	Goat willow	1	210	7	4	2	1	1.5	4	-	EM	Good	Fair	10-20	Twisted stem	Cii	2.5	20
6	Ash	1	190	14	1.5	1.5	1.5	1.5	8	-	EM	Good	Fair	20-40	Ivy	Cii	2.3	16
7	Alder	1	300	14	3	1	1	1.5	8	-	M	Good	Good	40+		Bii	3.6	41
7a	Ash	1	130	8	3	1	0	2	4	3-E	EM	Good	Good	20-40	Twisted stem	Cii	1.6	8
8	Alder	2	440	15	1.5	1.5	3.5	4	6	3-SW	M	Good	Good	40+		Bii	5.3	88
9	Ash	1	130	10	3	0	0	1.5	6	-	EM	Fair	Fair	10-20	Group of three trees	Cii	1.6	8
10	Alder	1	300#	10	3	3	3	3	6	-	M	Good	Good	40+	Group of seven trees, slender stems	Bii	3.6	41
10a	Alder	1	<300	14	2.5	2.5	2.5	2.5	6	-	M	Good	Good	20-40	Group of eleven trees, slender stems, dense ivy	Bii	3.6	41
11	Alder	3	520	16	1	1	3	4	8	-	M	Good	Good	20-40		Bii	6.2	122
12	Alder	1	380	18	1.5	1.5	1.5	1.5	10	-	M	Good	Good	20-40		Bii	4.6	65
13	Alder	1	220	16	1	1	1	1	8	-	M	Good	Good	20-40		Bii	2.6	22
14	Alder	1	360	18	1.5	1.5	1.5	1.5	10	-	M	Good	Good	20-40	Dense ivy	Bii	4.3	59

ID	*Species*	Stem No.	Trunk Diam (mm)	Height (m.)	Crown Spread (metres)				Clearance (metres)		Life stage	Health & Vigour	Structural Condition	Remaining useful life	*Observations*	Retention CATEGORY	Protection Radius (m)	RPA (m²)
					N	E	S	W	Mean	Lowest over site + Direction								
15	Ash	1	320	18	6	1	0	1	8	-	M	Fair	Fair	20-40	Ivy, lean to north	Cii	3.8	46
16	Ash	2	675	14	3.5	4	6	4	8	-	M	Fair	Fair	20-40	Ivy	Bii	8.1	206
17	Alder	5	385	14	1.5	1.5	3	1.5	8	-	M	Fair	Fair	20-40	Dense ivy	Bii	4.6	67
18	Alder	1	<320	18	3.5	3.5	3.5	3.5	8	-	M	Good	Good	40+	Group of eleven trees, ivy	Bii	3.8	46
19	Ash	1	295	17	2	2	2	2	8	-	M	Good	Good	40+		Bii	3.5	39
20	Alder	1	220	14	2.5	2.5	2.5	2.5	6	-	EM	Fair	Fair	10-20	Ivy, twisted stem	Cii	2.6	22
21	Alder	1	120	12	1.5	1.5	1.5	1.5	6	-	EM	Fair	Fair	10-20	Group of two trees, ivy, slender stems	Cii	1.4	7
22	Alder	3	570	20	4	4	5	3.5	8	-	M	Good	Good	40+		Bii	6.8	147
23	Alder	3	645	20	4	4	4	4	8	-	M	Good	Good	40+		Bii	7.7	188
24	Ash	1	270	16	2.5	2.5	2.5	2.5	8	-	M	Good	Good	40+		Bii	3.2	33
24a	Alder	1	180	12	1.5	1.5	1.5	1.5	6	-	EM	Fair	Fair	20-40		Cii	2.2	15
25a	Ash	1	210	14	2.5	2.5	2.5	2.5	6	-	EM	Good	Good	40+		Cii	2.5	20
25b	Ash	1	160	14	2.5	2.5	2.5	2.5	6	-	EM	Good	Good	40+		Cii	1.9	12
25c	Ash	1	120	14	2.5	2.5	2.5	2.5	6	-	EM	Good	Good	40+	Ivy, lean to north	Cii	1.4	7
26	Alder	1	300	12	1	3	1	3	8	-	M	Fair	Fair	10-20	Dense ivy, deadwood	Cii	3.6	41
27	Alder	2	495	18	1.5	1.5	4	1.5	6	-	M	Good	Good	40+	Group of seven trees	Bii	5.9	111
28	Wych elm	1	270	14	1	2.5	3	2	2	2-S	EM	Fair	Fair	10-20	Twisted stem	Cii	3.2	33

ID	*Species*	Stem No.	Trunk Diam (mm)	Height (m.)	Crown Spread (metres)				Clearance (metres)		Life stage	Health & Vigour	Structural Condition	Remaining useful life	*Observations*	Retention CATEGORY	Protection Radius (m)	RPA (m²)
					N	E	S	W	Mean	Lowest over site + Direction								
29	Alder	2	440	16	3	3	3	3	8	-	M	Good	Good	40+		Bii	5.3	88
30	Alder	3	480	16	3	3	3	3	8	-	M	Good	Good	40+		Bii	5.8	104
31	Unknown	1	600#	3	-	-	-	-	-	-	M	Dead	Poor	<10	Decayed stump, ivy	U	7.2	-
32	Alder	1	540	20	1	3	4	1.5	8	-	M	Good	Good	40+		Bii	6.5	132
33	Alder	1	600	22	1	3	5	1.5	10	-	M	Good	Good	40+		Bii	7.2	163
34	Alder	1	700	24	3.5	4	5.5	3	10	-	M	Good	Good	40+		Bii	8.4	222
35	Sycamore	1	160	8	1	1.5	2.5	1	1.5	-	EM	Fair	Fair	10-20		Cii	1.9	12
36	Ash	1	550	24	1	5	7.5	4	6	2-S	M	Fair	Fair	20-40	Lean to south, asymmetrical canopy, deadwood	Bii	6.6	137
37	Alder	2	625	18	1.5	4	4	1	8	-	M	Good	Good	40+	Ivy	Bii	7.5	177
38	Ash	1	550	20	1	5	4	2	8	-	M	Good	Good	40+		Aii	6.6	137
39	Ash	1	550	20	4	1	1	4.5	8	-	M	Good	Good	40+		Aii	6.6	137
40	Alder	1	380	18	1	1	1	1	10	-	M	Dead	Poor	<10	Dead stem, dense ivy	U	4.6	-
41	Wych elm	1	140	2.5	1	1	1	1	2	-	EM	Fair	Fair	10-20	Topped at 2.5m	Cii	1.7	9
42	Alder	3	490	18	4	3	1	6	6	-	M	Good	Fair	10-20	Stream side location	Bii	5.9	109
43	Alder	1	440	16	3	3	3	3	4	-	M	Good	Good	40+	Lean to south-east, dense ivy	Bii	5.3	88
44	Alder	1	490	18	3	3	3	3	4	-	M	Good	Fair	40+	Basal decay cavity	Bii	5.9	109
45	Alder	2	400	16	3	3	3	3	4	-	M	Good	Good	40+	Lean to north-west	Bii	4.8	72

ID	*Species*	Stem No.	Trunk Diam (mm)	Height (m.)	Crown Spread (metres) N	E	S	W	Clearance (metres) Mean	Lowest over site + Direction	Life stage	Health & Vigour	Structural Condition	Remaining useful life	*Observations*	Retention CATEGORY	Protection Radius (m)	RPA (m²)
46	Alder	2	600#	17	2	3	4	3	4	-	M	Good	Fair	20-40		Bii	7.2	163
47	Sycamore	1	220	12	1	3	4	1.5	4	-	EM	Fair	Fair	10-20	Pruned back over gate	Cii	2.6	22
48	Alder	1	150	8	2	2	2	2	3	-	EM	Fair	Fair	20-40		Cii	1.8	10
49	Alder	1	750#	22	4.5	4.5	4.5	4.5	3	-	M	Good	Good	40+	Located on opposite side of stream	Aii	9.0	254
50	Hazel	m/s	400#	10	2	2	1	2	1	-	M	Fair	Fair	10-20	Located on edge of stream, pruned back roadside	Ci	4.8	72
51	Alder	1	100	10	1.5	1.5	1.5	1.5	6	-	EM	Fair	Fair	10-20	Slender stem, located opposite side of stream	Ci	1.2	5
52	Wych elm	1	220	14	2.5	2.5	2.5	2.5	6	-	EM	Good	Good	20-40	Located on edge of stream	Ci	2.6	22
53	Alder	3	485	18	4	4.5	4	2	6	-	M	Good	Good	20-40	Located opposite side of stream	Bii	5.8	106
54	Alder	3	570	18	4	5	6	6	8	-	M	Good	Fair	20-40	Ground clearance works recently carried out at base of tree, minor root damage	Bii	6.8	147
55	Spruce	1	430	18	3	3	3	3	6	-	M	Good	Fair	20-40	Ground clearance works recently carried out at base of tree, minor root damage	Bii	5.2	84
56	Spruce	1	300	18	3	3	3	3	6	-	M	Good	Fair	20-40	Ground clearance works recently carried out at base of tree, minor root damage	Bii	3.6	41
57	Spruce	1	280	18	3	3	3	3	6	-	M	Good	Fair	20-40	Ground clearance works recently carried out at base of tree, minor root damage	Bii	3.4	35
58	Spruce	1	300	18	3	3	3	3	6	-	M	Good	Fair	20-40	Ground clearance works recently carried out at base of tree, minor root damage	Bii	3.6	41
59	Spruce	1	350	18	3	3	3	3	6	-	M	Good	Fair	20-40	Ground clearance works recently carried out at base of tree, minor root damage	Bii	4.2	55

ID	*Species*	Stem No.	Trunk Diam (mm)	Height (m.)	Crown Spread (metres) N	E	S	W	Clearance (metres) Mean	Lowest over site + Direction	Life stage	Health & Vigour	Structural Condition	Remaining useful life	*Observations*	Retention CATEGORY	Protection Radius (m)	RPA (m²)
60	Spruce	1	340	18	3	3	3	3	6	-	M	Good	Fair	20-40	Ground clearance works recently carried out at base of tree, minor root damage	Bii	4.1	52
61	Oak	1	275	14	4	4	4	4	2.5	-	M	Good	Good	20-40	Ground clearance works recently carried out at base of tree, minor root damage	Bii	3.3	34
62	Spruce	1	460	18	3	3	3	3	6	-	M	Good	Fair	20-40	Ground clearance works recently carried out at base of tree, minor root damage	Bii	5.5	96
63	Spruce	1	620	18	3	3	3	3	6	-	M	Dead	Poor	<10	Moribund tree	U	7.4	-
64	Spruce	1	410	18	3	3	3	3	6	-	M	Good	Fair	20-40	Ground clearance works recently carried out at base of tree, minor root damage	Bii	4.9	76
65	Ash	1	150	10	1.5	1.5	1.5	1.5	4	-	EM	Good	Good	20-40		Cii	1.8	10
66	Sycamore	1	220	6	1.5	1.5	1.5	1.5	4	-	EM	Good	Good	20-40		Cii	2.6	22
67	Sycamore	2	280	10	2.5	2.5	2.5	2.5	6	-	EM	Good	Good	20-40	Group of five located within remnant hedge bank	Cii	3.4	35
68	Sycamore	2	180	10	2.5	2.5	2.5	2.5	6	-	EM	Good	Good	20-40	Located within remnant hedge bank	Cii	2.2	15
69	Sycamore	2	300	10	2.5	2.5	2.5	2.5	6	-	EM	Good	Good	20-40	Located within remnant hedge bank, squirrel damage	Cii	3.6	41
70	Ash	1	320	10	2	2	2	2	4	-	EM	Good	Fair	20-40	Located within remnant hedge bank, previously coppiced, 'U' shaped stem	Cii	3.8	46
71	Ash	3	310	12	4	4	4	4	8	-	EM	Good	Good	20-40	Located within remnant hedge bank	Cii	3.7	43
72	Sycamore	2	150	8	1.5	1.5	1.5	1.5	4	-	EM	Good	Good	20-40	Located within remnant hedge bank	Cii	1.8	10
73	Ash	1	280	12	2.5	2.5	2.5	2.5	6	-	EM	Good	Good	20-40	Located within remnant hedge bank	Cii	3.4	35

ID	*Species*	Stem No.	Trunk Diam (mm)	Height (m.)	Crown Spread (metres)				Clearance (metres)		Life stage	Health & Vigour	Structural Condition	Remaining useful life	*Observations*	Retention CATEGORY	Protection Radius (m)	RPA (m²)
					N	E	S	W	Mean	Lowest over site + Direction								
74	Sycamore	5	330	10	4	4	4	4	1	-	EM	Good	Good	20-40	Located within remnant hedge bank	Cii	4.0	49
75	Sycamore	1	120	6	1.5	1.5	1.5	1.5	4	-	EM	Good	Good	20-40	Located within remnant hedge bank	Cii	1.4	7
76	Sycamore	1	120	6	1.5	1.5	1.5	1.5	4	-	EM	Good	Good	20-40	Group of three trees, located within remnant hedge bank	Cii	1.4	7
77	Ash	m/s	400#	14	5	5	5	5	6	-	M	Good	Fair	20-40	Group of five trees, located within remnant hedge bank	Cii	4.8	72
78	Cherry	2	400	10	4	5	3	1	3	-	M	Good	Good	20-40	Dense ivy	Cii	4.8	72
79	Cherry	3	300	8	4	5	2	1.5	3	-	M	Good	Good	20-40	Dense ivy	Cii	3.6	41
80	Pine	1	260	14	2	2	2	2	6	-	M	Good	Good	40+		Bii	3.1	31
81	Pine	1	265	14	2	2	2	2	6	-	M	Good	Good	40+		Bii	3.2	32
82	Pine	1	245	14	2	2	2	2	6	-	M	Good	Good	40+		Bii	2.9	27
83	Pine	1	180	14	2	2	2	2	6	-	M	Good	Good	40+		Bii	2.2	15
84	Pine	1	360	14	2	2	2	2	6	-	M	Good	Good	40+		Bii	4.3	59
85	Pine	1	280	14	2	2	2	2	6	-	M	Good	Good	40+		Bii	3.4	35
86	Spruce	1	450	16	3	3	3	3	2.5	-	M	Good	Good	20-40	Ivy	Bii	5.4	92
87	Lawson cypress	m/s	690	16	3	3	3	3	2	-	M	Good	Good	20-40		Bii	8.3	215
88	Pine	1	350	15	3	3	3	3	6	-	M	Good	Good	40+		Bii	4.2	55
89	Pine	1	320	15	3	3	3	3	6	-	M	Good	Good	40+		Bii	3.8	46

ID	*Species*	Stem No.	Trunk Diam (mm)	Height (m.)	Crown Spread (metres)				Clearance (metres)		Life stage	Health & Vigour	Structural Condition	Remaining useful life	*Observations*	Retention CATEGORY	Protection Radius (m)	RPA (m²)
					N	E	S	W	Mean	Lowest over site + Direction								
90	Pine	1	360	15	3	3	3	3	6	-	M	Good	Good	40+		Bii	4.3	59
91	Pine	1	250	15	3	3	3	3	6	-	M	Good	Good	40+		Bii	3.0	28
92	Oak	1	640	16	3.5	5	6.5	6	6	-	M	Good	Good	40+	Located on edge of lined channel	Ai	7.7	185
93	Pine	2	395	10	3	3	3	3	6	-	M	Good	Good	40+		Bii	4.7	71
94	Pine	1	300	10	3	3	3	3	6	-	M	Good	Good	40+		Bii	3.6	41
95	Pine	1	350	8	3	3	3	3	6	-	M	Good	Good	40+		Bii	4.2	55
96	Pine	1	320	10	3	3	3	3	6	-	M	Good	Good	40+		Bii	3.8	46
97	Pine	1	430	10	3	3	3	3	6	-	M	Good	Good	40+		Bii	5.2	84
98	Pine	1	350	13	3	3	3	3	6	-	M	Good	Good	40+		Bii	4.2	55
99	Pine	1	310	14	3	3	3	3	6	-	M	Good	Good	40+		Bii	3.7	43
100	Pine	1	420	14	3	3	4	2	2.5	-	M	Good	Good	40+		Ai	5.0	80
101	Pine	1	710	12	4	2.5	4	6	3	-	M	Good	Good	40+	Twisted stem	Ai	8.5	228
102	Pine	1	400	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	4.8	72
103	Pine	1	350	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	4.2	55
104	Pine	1	320	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	3.8	46
105	Pine	1	310	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	3.7	43
106	Pine	1	220	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	2.6	22

ID	*Species*	Stem No.	Trunk Diam (mm)	Height (m.)	Crown Spread (metres) N	E	S	W	Clearance (metres) Mean	Lowest over site + Direction	Life stage	Health & Vigour	Structural Condition	Remaining useful life	*Observations*	Retention CATEGORY	Protection Radius (m)	RPA (m²)
107	Pine	1	390	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	4.7	69
108	Pine	1	250	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	3.0	28
109	Pine	1	260	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	3.1	31
110	Pine	1	410	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	4.9	76
111	Cherry	1	270	14	3	3	3	3	2.5	-	M	Good	Good	40+		Cii	3.2	33
112	Pine	1	250	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	3.0	28
113	Pine	1	320	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	3.8	46
114	Pine	1	350	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	4.2	55
115	Pine	1	290	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	3.5	38
116	Pine	1	330	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	4.0	49
117	Pine	1	400	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	4.8	72
118	Pine	1	340	14	3	3	3	3	2.5	-	M	Good	Good	40+		Bii	4.1	52
119	Cherry	3	485	15	2	6	1	3	3	-	M	Fair	Fair	20-40		Cii	5.8	106
120	Goat willow	m/s	900	12	7	6	8	8	2.5	-	LM	Fair	Fair	10-20		Ci	10.8	366
121	Ash	1	720	16	5	5	4	4	3	-	M	Fair	Fair	20-40		Bii	8.6	235
122	Ash	1	850	17	8	5	6	5	6	-	M	Good	Fair	20-40	Ivy	Aii	10.2	327
123	Cherry	1	250	14	3	3	3	3	2.5	-	M	Fair	Fair	10-20		Cii	3.0	28

ID	*Species*	Stem No.	Trunk Diam (mm)	Height (m.)	Crown Spread (metres) N	E	S	W	Clearance (metres) Mean	Lowest over site + Direction	Life stage	Health & Vigour	Structural Condition	Remaining useful life	*Observations*	Retention CATEGORY	Protection Radius (m)	RPA (m²)
124	Cherry	1	280	14	3	3	3	3	2.5	-	M	Fair	Fair	10-20		Cii	3.4	35
125	Cherry	4	330	14	3	3	3	3	2.5	-	M	Fair	Fair	10-20		Cii	4.0	49
126	Cherry	4	330	14	3	3	3	3	2.5	-	M	Fair	Fair	10-20		Cii	4.0	49
127	Cherry	3	340	14	3	3	3	3	2.5	-	M	Fair	Fair	10-20		Cii	4.1	52
128	Pine	1	380	14	3	3	3	3	2.5	-	M	Fair	Fair	10-20		Cii	4.6	65
129	Cherry	2	340	14	3	3	3	3	2.5	-	M	Fair	Fair	10-20		Cii	4.1	52
130	Ash	2	410	14	3	3	3	3	2.5	-	M	Fair	Fair	10-20		Cii	4.9	76
131	Ash	1	440	15	5	2.5	7.5	5	6	4-N	M	Good	Good	20-40	Located on low circular stone wall, ivy	Bii	5.3	88
132	Ash	1	270	14	1	3	2	2	8	-	EM	Fair	Good	20-40	Located within valve area, ivy, slender stem	Cii	3.2	33
133	Ash	1	390	15	3	5	5	1	6	4-E	M	Good	Good	20-40	Located adjacent low circular stone wall, ivy	Bii	4.7	69
G1	Alder, ash	1	<180	14	1.5 x 1.5				6	-	EM	Good	Good	20-40		Cii	2.2	-
G2	Alder	m/s	<340	18	1.5 x 1.5				6	-	M	Good	Good	40+	Dense ivy	Bii	4.1	-
G3	Alder, sycamore	1	<500	20	3 x 3				10	-	M	Good	Good	40+	Dense ivy, understory of sycamore (<150mm)	Bii	6.0	-
G4	Sycamore	1	<180	10	3 x 3				10	-	EM	Fair	Fair	10-20		Cii	2.2	-
G5	Alder	1	<450	24	4 x 4				10	-	M	Good	Good	40+	Dense ivy, basal decay cavities	Aiii	5.4	-
G6	Rowan	1	<130	8	2 x 2				3	-	EM	Fair	Fair	10-20	Group of four trees, bramble	Cii	1.6	-

ID	*Species*	Stem No.	Trunk Diam (mm)	Height (m.)	Crown Spread (metres) N	E	S	W	Clearance (metres) Mean	Lowest over site + Direction	Life stage	Health & Vigour	Structural Condition	Remaining useful life	*Observations*	Retention CATEGORY	Protection Radius (m)	RPA (m²)
G7	Hornbeam, field maple, hazel, oak	m/s	<150	0.5	3 x 3				0.5	-	EM	Fair	Fair	10-20	Group of seven trees, bramble	Cii	1.8	-
G8	Ash	m/s	<100	10	1.5 x 1.5				2	-	Y	Fair	Fair	10-20	Self-seeded trees on top of concrete lined channel	Cii	1.2	-
G9	Western red cedar	1	<800	22	5 x 5				2	-	M	Good	Good	40+	Group of two trees	Cii	9.6	-
G10	Spruce	1	<500	24	1.5 x 1.5				2	-	M	Good	Good	40+	Plantation	Cii	6.0	-

- The report has been framed as an 'Arboricultural Constraints Report', as defined in BS5837:2012 - *Trees in relation to design, demolition & construction-Recommendations*. Its purpose is to set out and to quantify the degree of constraint offered by existing tree cover with regard to any development or alteration in land-use that may be proposed and is intended to be used to inform feasibility studies and design options. As such it reflects the conditions *as they existed at the time of our inspections*: no account has been taken of any specific development proposals, although it has been assumed that certain unspecified alterations in site usage patterns are likely to occur, which are likely to result in an increase in site occupancy levels. Additional arboricultural input may be required at subsequent stages of design, planning and implementation in relation to the assessment & management of possible arboricultural impacts.

- The survey parameters are as set out in BS5837:2012 and based on the findings each tree or group is allocated to one of four 'Retention Categories' (see Appendix 2, p2). The factors taken into account in categorising the trees include their overall arboricultural quality, their general health and structural stability, their likely useful life-expectancy, their significance to the local landscape and general public amenity value, the degree to which they provide wildlife habitat and enhance local biodiversity and any other social or cultural values that they may embody.

- Also integral to the methodology of BS5837 is the calculation of **Root Protection Areas (RPAs)** for each of the trees in question. The RPA is defined as a "*layout design tool indicating the minimum area around a tree deemed to contain sufficient roots and rooting volume to maintain the tree's viability, and where the protection of the roots and soil structure is treated as a priority."*

- It should be noted that in most cases the plan accompanying this report will show the *nominal* RPAs of the trees, indicated as circles centred upon the tree of a radius such that they enclose an area equal to the relevant RPA. In practice the distribution of roots around a tree will frequently prove to be uneven due to the presence of a variety of constraining influences. These may be physical barriers such as existing foundations etc, or the existence of localised soil conditions inhospitable to root growth, such as waterlogging or soil compaction. Conversely, soil conditions may be particularly *conducive* to root development in one quarter and this might also lead to an asymmetric distribution of roots around the tree. However in most cases the nominal circular areas as indicated will provide a reasonable guide as to where special measures will be required to protect tree roots and preserve good soil condition.

- The RPAs of the trees will provide the basis for defining **Construction Exclusion Zones (CEZs),** these being areas around all of those trees intended to be retained where access should be prevented throughout the entire process of site preparation and construction. In certain cases the CEZ will exceed the size of the RPA in order to accommodate the aerial parts of wide-spreading trees.

- Access within the CEZ should be prevented through the erection of barriers, constructed in accordance with BS5837:2012. Where access within an RPA is unavoidable, appropriate ground protection should be installed. Outline details of the design of suitable barriers and ground protection are given in Appendices A & B. These protection measures should be put in place prior to any site clearance or construction work commencing on the site and they should remain *in situ* until all works have been completed. Some activities within the CEZs may be acceptable but should not be put in hand until appropriate arboricultural advice has been sought.

The **DIMENSIONS** Taken are:

- **STEM-No.** indicates the number of main stems (i.e. whether the trunk divides at or below 1.5m; (Used in the calculation of RPA.) "m-s" = Multi-stemmed.
- **DIAMETER** (in centimetres), obtained from the girth measured at approx.1.5m. For trees with 2 to 5 sub-stems, a notional figure is derived from the sum of their cross-sectional areas. For multi-stemmed trees the notional diameter may be estimated on the basis of the average stem size x the number of stems. (A notional diameter may be estimated where measurement is not possible.)
- **HEIGHT**, estimated and expressed in metres.
- The **CROWN SPREAD** is expressed in terms of the crown radii estimated at the four cardinal points (or as otherwise specified) and given in metres.
- **CLEARANCES** are indicated as an estimate of the *mean, overall* height of the canopy above ground level with an additional figure for the height above ground of the *lowest significant branch* within the site, together with the direction of its growth.

LIFE STAGE is defined as follows:

P recently Planted; sapling: A tree that is still establishing and which would be relatively easy to replace or even transplant. Likely to be vulnerable to damage from (e.g.) strimmers, mowing equipment, drought, vandals, etc. (Easily replaced thus a negligible constraint).

Y Young, establishing trees. Should be growing fast, usually primarily increasing in height more than spread, but as yet making limited impact upon the landscape.

EM Early-mature. Established young trees, normally of good vigour and still increasing in height, but beginning to spread laterally. Beginning to make an impact upon the local landscape & environment.

M Mature: Well-established trees, still growing with some vigour, but tending to fill out and increase spread. Bark may be beginning to crack & fissure. In the middle half of their safe, useful life-expectancies.

LM Late-Mature: In full maturity. Still retaining some vigour but growth slowing.

O Old: Fully mature with vigour declining. Likely to possess features that could be regarded as potential faults, such as large, ponderous branches, old wounds etc. etc., but also likely to be of high amenity value.

A Ancient: Old trees can survive for very many years with healthy growth continuing although the tree may be of low vigour. Crown size usually becomes reduced, either through natural branch-loss or through management (e.g. pollarding). Decay is usually present. Such trees may embody certain hazards but they are also likely to be of considerable conservation value (i.e. "Veteran" trees).

HEALTH & VIGOUR: Essentially a snapshot of the general health of the tree based upon its general appearance, its apparent vigour and the presence or absence of symptoms associated with poor health, physiological stress etc. (Fungal infections may be recorded here but *decay giving rise to structural weakness* would be recorded under 'Structural Condition' – see next parameter):

Good no significant health issues.

Fair indications of slight stress or minor disease (e.g. the presence of minor dieback/deadwood or of epicormic shoot growth)

Poor Significant stress or disease noted; larger areas of dieback than above

Bad Severe decline; widespread dieback and/or severe stress; life-threatening disease.

Dead (or Moribund)

STRUCTURAL CONDITION: Defects affecting the structural stability of the tree, including decay, significant dead wood, root-plate instability or significant damage to structural roots, weak forks (e.g. those where bark is included between the members) etc. etc. Classified as:

Good No obvious structural defects: basically sound

Fair Minor, potential or incipient defects

Poor Significant defect(s) likely to lead to actual failure in the medium to long-term

Bad Defects liable to cause significant failure in the short term, or to lead to a major or total collapse in the foreseeable future

Severe Tree that has already suffered or is at imminent risk of a major collapse.

REMAINING USEFUL LIFE EXPECTANCY: An estimate of the length of time in years that a tree might be expected to continue to make a useful contribution to the locality at an acceptable level of risk (based on an assumption of continued routine maintenance)

V	-	less than 10 years	S	-	10+ years
M	-	20+ years	L	-	40+ years

RETENTION CATEGORY: Trees are classed as category **U, A, B** or **C**, based on criteria given in BS5837:2012; summary definitions as follow (see BS5837 for further details). Categories A, B and C are further characterised by the use of sub-categories, which attempt to identify what aspect of the tree is the main source of its perceived value:
(**i**) **arboricultural** qualities (**ii**) **landscape** qualities and (**iii**) **cultural, historic or ecological/conservation** qualities. Examples of these qualities for each of the three categories are given below, although these are indicative only.

Note: *This is NOT a health and safety classification; the classification does not take into account any requirement for remedial tree care or ongoing maintenance apart from that which may affect the trees' general suitability for retention.*

U UNSUITABLE: (red) Trees likely to prove to be unsuitable for retention for longer than 10 years should any significant increase in site usage arise as a result of development.

Dead or moribund trees; those at risk of collapse or in terminal decline;; trees that will be left unstable by other essential works such as the removal of nearby category U trees; trees infected by pathogens that could materially affect other trees; low quality trees that are suppressing better specimens

(Category U trees may have conservation values which it might be desirable to preserve.
It may also include trees that should be removed irrespective of *any* development proposals.)

A HIGH QUALITY (green) Trees or groups whose retention should be given a particularly high priority within the design process. Normally with an expected useful life-expectancy of at least 40 years.

(i) Notably fine specimens; rare or unusual specimens; essential component trees within groups, semi-formal or formal plantings (e.g. dominant trees within an avenue etc.)

(ii) Trees, groups or woodlands of particular visual importance as landscape features.

(iii) Trees, groups or woodlands of particular significance by virtue of their conservation, historical, commemorative or other value (e.g. veteran trees or wood pasture.)

B MODERATE QUALITY (blue): Trees or groups of some importance with a likely useful life-expectancy in excess of 20 years. Their retention would be highly desirable; selective removal of certain individuals may be acceptable, but only after full consideration of all alternative courses of action.

(i) Fair quality but not exceptional; good specimens showing some impairment (e.g. remediable defects, minor storm damage or poor past management.)

(ii) Acceptable trees situated such as to have little visual impact within the wider locality. Also numbers of trees, perhaps in groups or woodlands, whose value as landscape features is greater collectively *than would warrant as individuals (such that the selective removal of an individual would not impact greatly upon the trees' overall, collective value).*

(iii) Trees, groups or woodlands with clearly identifiable conservation or other cultural benefits.

C MINOR VALUE (grey): Trees or groups of rather low quality, although potentially capable of retention for at least approx. 10 years. *Also* small trees below 15cm diam.
Potentially retainable, but not of sufficient value to be regarded as a significant planning constraint.

(i) Unremarkable trees of very limited merit or of significantly impaired condition.

(ii) Trees offering only low or short-term landscape benefits; also secondary specimens within groups or woodlands whose loss would not significantly diminish their landscape value.

(iii) Trees with extremely limited conservation or other cultural benefit.

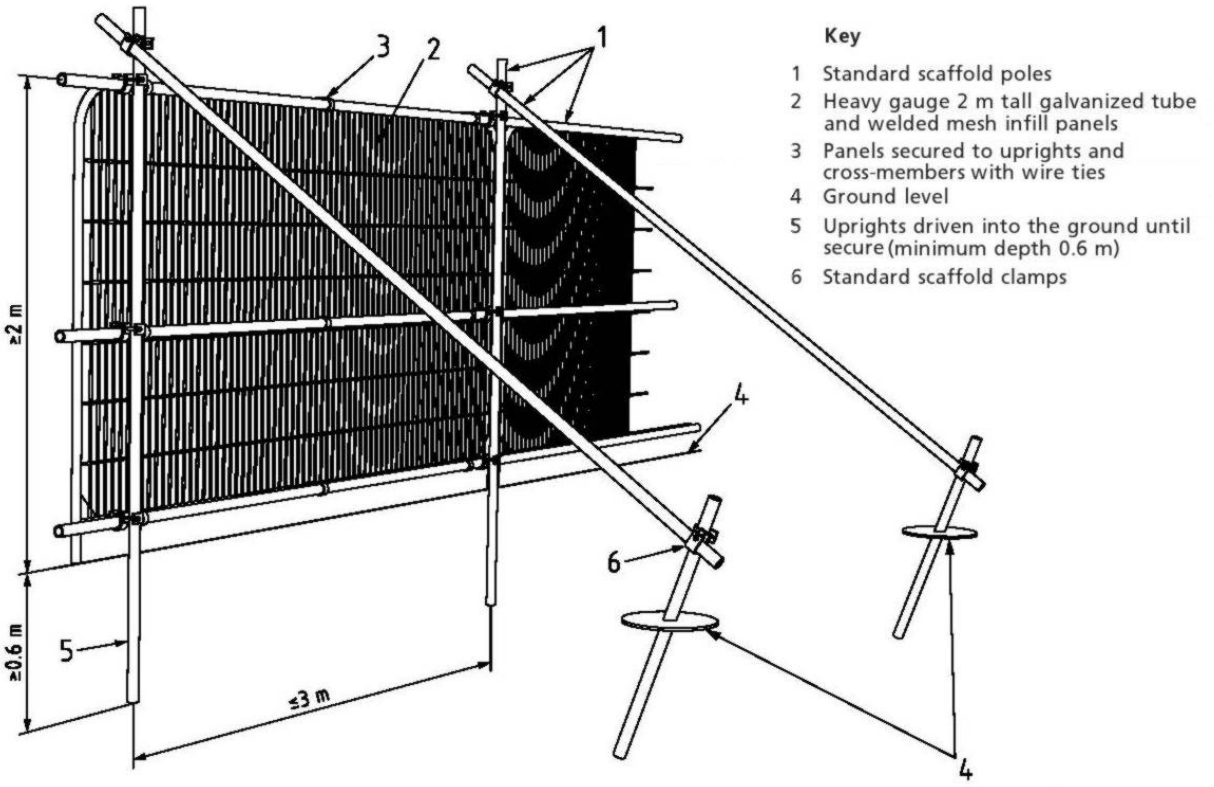
ROOT PROTECTION AREA (RPA): *This is the area in square metres formed by a circle of radius* (the **Protection Radius**) *twelve times the actual or notional stem diameter of the tree (see 'Diameter', above). The RPA represents the minimum area deemed to contain sufficient roots & soil to maintain the tree's viability. It is the basis whereby the layout of the* **Construction Exclusion Zone (CEZ)** *is determined, which should encompass an area equal to the RPA, although its form may be adapted in the light of arboricultural considerations and pre-existing physical constraints. The CEZ should be protected by sturdy temporary fencing (see BS5837:2012) throughout the entire process of site preparation and construction.*

*A **CONSTRUCTION EXCLUSION ZONE** should be established around all trees intended for retention, based upon the Root Protection Areas (RPAs) of those trees. These zones should be adequately protected by appropriately designed **Protective Barriers** & **Ground Protection** throughout the all demolition & construction processes.*

A: PROTECTIVE BARRIERS

- Vertical barriers should be erected and ground protection installed **before any materials or machinery are brought onto the site and before any demolition, development or stripping of soil commences**. Areas of new or retained structure planting should be similarly protected, based on the extent of the soft landscaping as shown on the approved drawings. The project arboriculturist should confirm that barriers and ground protection have been erected and set out correctly prior to the commencement of other operations, and that they are fit for purpose
- Where required, pre-development tree work may be undertaken before the installation of tree protection, with the agreement of the project arboriculturist and the local planning authority.
- **Once erected, barriers and ground protection should be regarded as sacrosanct,** and should not be removed or altered without prior recommendation by the project arboriculturist and approval of the local planning authority.
- Barriers should be fit for the purpose of excluding construction activity and appropriate to the degree and proximity of work taking place around the retained tree(s). On all sites, special attention should be paid to ensuring that barriers remain rigid and complete.
- In most cases, barriers should consist of a scaffold framework in accordance with the illustration below, comprising a vertical and horizontal framework, well braced to resist impacts, with vertical poles spaced at a maximum interval of 3m. Onto this, weldmesh panels should be securely fixed.

Default specification for protective barrier



- Where driven vertical poles are impractical due to the likelihood of causing damage to tree roots or to underground services, above-ground stabilizing systems may be specified.
- Alternative specifications may be acceptable but should be specified in conjunction with the project arboriculturist but they must always ensure an adequate degree of protection for the conditions likely to obtain on site. Weldmesh panels on rubber or concrete feet may be sufficient where protection is only required from pedestrians, cars, vans and manually operated plant, but in such cases the panels should be securely joined together using a minimum of two anti-tamper couplers, installed so that they can only be removed from inside the fence. The panels should be supported on the inner side by stabilizer struts.
- It may be appropriate on some sites to use temporary site office buildings as components of the tree protection barriers.

B: GROUND PROTECTION

- Where construction working space or temporary construction access is justified within the RPA, this should be facilitated by a set-back in the alignment of the tree protection barrier. In such areas, suitable existing hard surfacing that is not proposed for re-use as part of the finished design should be retained to act as temporary ground protection during construction, rather than being removed during demolition. The suitability of such surfacing for this purpose should be evaluated by the project arboriculturist and an engineer as appropriate
- However, where the set-back of the tree protection barrier would expose unmade ground to construction damage, new temporary ground protection should be installed as part of the implementation of physical tree protection measures prior to work starting on site. Such temporary ground protection should be capable of supporting any traffic entering or using the site without being distorted or causing compaction of underlying soil.
- The ground protection might comprise one of the following:
    - *a) for pedestrian movements only, a single thickness of scaffold boards placed either on top of a driven scaffold frame, so as to form a suspended walkway, or on top of a compression-resistant layer (e.g. 100 mm depth of woodchip), laid onto a geotextile membrane;*
    - *b) for pedestrian-operated plant up to a gross weight of 2 t, proprietary, inter-linked ground protection boards placed on top of a compression-resistant layer (e.g. 150 mm depth of woodchip), laid onto a geotextile membrane;*
    - *c) for wheeled or tracked construction traffic exceeding 2 t gross weight, an alternative system (e.g. proprietary systems or pre-cast reinforced concrete slabs) to an engineering specification designed in conjunction with arboricultural advice, to accommodate the likely loading to which it will be subjected.*
- In all cases, the objective should be to avoid compaction of the soil, which can arise from the single passage of a heavy vehicle, especially in wet conditions, so that tree root functions remain unimpaired.

C: ADDITIONAL PRECAUTIONS OUTSIDE THE EXCLUSION ZONE:

- Once the exclusion zone has been protected by barriers and/or ground protection, construction work can commence. All weather notices should be erected on the barrier with words such as:

Construction exclusion zone – NO ACCESS

In addition the following should be addressed or avoided.

- Care should be taken when planning site operations to ensure that wide or tall loads, or plant with booms, jibs and counterweights (including drilling and piling rigs) can operate without coming into contact with retained trees. Such contact can result in serious damage to them and might make their safe retention impossible. Consequently, any transit or traverse of plant in close proximity to trees should be conducted under the supervision of a banksman to ensure that adequate clearance from trees is maintained at all times. In some circumstances it may be impossible to maintain adequate clearance thus necessitating access facilitation pruning. Local Planning Authority consent for such pruning may be required.
- Material which will contaminate the soil, e.g. concrete mixings, diesel oil and vehicle washings, should not be discharged within 10 m of the tree stem.
- Fires should be avoided on sites if at all possible. Where they are unavoidable they must not be lit in a position where heat could affect the trunk, branches or foliage of any tree. The size of the fire and the wind direction should be taken into account, and fires must be attended at all times.
- Notice boards, telephone cables or other services should not be attached to any part of the tree.
- It is essential that allowance should be made for the slope of the ground so that damaging materials such as concrete washings, mortar or diesel oil cannot run towards trees..

D: ROADS, DRIVEWAYS AND PATHS NEAR TREES (including outline notes on 3-dimensional 'Cellular Confinement' load-support systems)

1. The overriding principles to be adhered to in the design of hard surfaces near trees are: (i) the preservation of the character of the soil in a form no more compacted or otherwise disturbed, disrupted or contaminated than it is at present; (ii) to maintain gaseous exchange between the upper layers of soil and the atmosphere; (iii) to ensure adequate (but not excessive) water supply to the soil; and (iv) the avoidance of damage to retained trees as a result of root severance, crushing or abrasion.
2. Tree roots are concentrated in the upper metre of the soil, with the great majority 300-600 mm below the soil surface. Beyond 3 or 4 metres from the trunk most of the roots are small in diameter and not readily apparent as originating from trees. They are nevertheless vital to the tree's well-being, as well as being very easily damaged by even rather shallow soil disturbance, such as may be required in establishing a path or driveway.
3. Wherever possible paths etc should be routed well outside the Root Protection Area (RPA), when problems should not arise. Note, however, that the position of a path or road on a layout plan may indicate the surface only: *Allowance must be made for any kerbing, and the footing into which kerbs will be set, when considering possible conflicts between trees and nearby paths, roadways etc*.
4. Where there is no alternative other than for such a route to impinge upon the RPA of a tree, the possibility of damage can be significantly reduced through the use of No-Dig techniques, where an adequately load-bearing sub-base and hard-wearing surface is established over existing roots without them being disturbed. A variety of techniques are available including three-dimensional cellular confinement systems[1]. Alternatively, piles, pads or elevated beams can be used to support surfaces to bridge over the RPA or, following exploratory investigations to determine location, to provide support within the RPA while allowing the retention of roots greater than 25 mm in diameter. The design of all such systems should be specified in liaison with the project arboriculturist.
5. Temporary haul roads must be similarly designed and specified, taking into account the extra loading that is likely to be imposed by construction traffic. Where proposed *permanent* new surfaces will be used for construction access, it is essential that this extra loading and wear is taken into account during the design process. A temporary sacrificial wearing surface may be required for the duration of construction activity.
6. Wherever possible, new surfaces should permit the percolation of moisture into the soil and allow free gaseous exchange. Suitable permeable wearing course include washed gravel (either loose or in laid gravel-retention grids, but note that self-binding gravels and 'hoggin' is NOT suitable) or paving slabs or block pavers with built-in infiltration spaces. These must be laid dry-jointed, bedded onto a free-draining sub-base such as sharp sand or coarse, no-fines aggregate. Porous asphalt and resin-bonded gravels will provide good porosity initially but will eventually become blocked by fines and should be laid following the principles used for impermeable surfaces (see below).
7. New permanent impermeable hard surfacing should not exceed 20% of any existing un-surfaced ground within the RPA. The hard surface should be resistant to or tolerant of deformation by tree roots, and should be set back from the stem of the tree and its above-ground root buttressing by a minimum of 500 mm to allow for growth and movement. Resulting gaps may be filled using appropriate inert granular material.
8. Prior to and during installation, the soil structure in the area beneath the proposed new surfacing must be protected from compaction, using temporary ground protection where necessary (see appendix 2B). During installation the new surface should be "rolled out", using machinery working forward from the surface as it is constructed.
9. If it proves necessary, existing surface vegetation should be killed using an *appropriate herbicide* that will not leach into the soil and will not affect tree roots. All herbicides must be applied strictly in accordance with the manufacturer's instructions.
10. The soil should not be skimmed to reduce ground levels. However loose organic matter and/or turf should be removed carefully, using hand tools. If the surface needs to be levelled or raised, this should be achieved using a suitable granular fill material (e.g. no-fines gravel, washed aggregate etc.)

[1] Suppliers of suitable proprietary products include Geosynthetics ('CellWeb') and Terram ('Geocell') and Greenfix ('Geoweb')