

THE EXPERT OPINION OF

Dr D P O'Callaghan, FICFor, F Arbor A, MISA

Dated:

03 February 2022

On behalf of

The Scout Association

On the Instructions of:

Kennedys Solicitors

Ref: [KEN-Legal.FID43490014]

Specialist Field:

Arboriculture, Tree Related Subsidence

Subject:

Alleged Tree Related Subsidence Damage at
27 Woodfield Way, London N11 2NP



DEALGA'S TREE CONSULTANCY LTD
Suite 9 St Andrews Business Centre,
91 St Mary's Road, Garston, Liverpool, L19 2NL
T: (0151) 494-5606: M: (07595) 530720
E: Dealga@dealgas-treeconsultancy.co.uk
www.dealgas-treeconsultancy.co.uk



Contents

1.	Introduction	3
1.1	Professional Details	3
1.2	Instructions & Documentation	3
1.3	Synopsis	3
1.4	The Issues to be Addressed	4
1.5	Appendices	4
2.	The Technical Investigation – Findings	5
3.	Discussion & Opinion	6
3.1	Causation	6
3.2	Other Vegetation	7
3.3	Reasonable foreseeability	8
4.	Conclusions	9
	Appendix 1 (Resumé)	10
	Appendix 2 (Documents)	15

1 Introduction

1.1 Professional Details

I am Dealga O'Callaghan, and I hold an Honours Baccalaureate Degree in Biology, (BSc Hons) and a Doctorate in Philosophy (PhD) in biological sciences. I am a Fellow of the Institute of Chartered Foresters, (FICFor), and a Chartered Arboricultural Consultant. I am also a Fellow of the Arboricultural Association (F.Arbor.A.) and a professional member of the International Society of Arboriculture (MISA). I practice as an Arboricultural Consultant through Dealga's Tree Consultancy Ltd (DTCL), which is based in Liverpool.

I am a consultant specialising in tree failure, hazard evaluation, risk assessment related to trees, planning and development where trees are involved, personal accidents involving trees, insurance claims where tree failure is involved and or building damage occurs which may be attributed to the activity of trees, tree valuation, tree preservation orders and trees in conservation areas, etc. Between November 2014 and March 2017, I was registered as a non-salaried inspector (NSI) at the Planning Inspectorate (PINS) for the Fast-Track TPO Appeals and other related casework. My Professional Resume and a list of my publications are at Appendix 1 to this report.

1.2 Instructions and Documentation

I am instructed to act in the matter of tree alleged related subsidence damage at 27 Woodfield Way, London N11 2NP (the 'Property') that was discovered in March 2020 and reported to insurers in August 2020. A mature oak tree and a group of trees comprised of ash; goat willow & sycamore (the 'Trees') have been implicated as the cause of the damage.

I have been asked to consider the documents supplied to me, which are listed at Appendix 2 to this opinion; to undertake a desktop study and a technical investigation, and to express my independent opinion on the arboricultural aspects of this case. Specifically, I am asked to provide an expert opinion as to whether on the balance of probabilities the Trees were a cause of the subsidence damage.

1.3 Synopsis

1.3.1 From the information supplied to me I understand that in March 2020 the policy holder and owner of the Property, Mr Jayantil Chohan noticed crack damage in the side extension to the Property. The policy holder notified his insurers on 27 August 2020.

1.3.2 I am further informed that following a site investigation (SI) on 07 April 2021; an arboricultural assessment on 09 June 2021; and level monitoring between 12 July 2021 and 04 November 2021; the engineers concluded that the damage was caused by clay shrinkage subsidence, and the shrinkage was caused by tree roots extracting moisture from the clay soil.

1 Introduction (Continued)

1.3 Synopsis (Continued)

1.3.3 The damage to the to the side extension is described internally vertical cracking in the front right bedroom, the utility room and toilet, and cracking in the tiles at the junction of the extension with the original house. Externally, stepped, and horizontal cracks in the storeroom lean-to; slumping of paving slabs adjacent to a retaining wall; vertical and stepped cracking to the retaining wall; and cracks to the side of the steps leading down from the patio. The structural damage has been classified as Category 2 ('slight') in Table 1 of BRE 251, '*Assessment of damage in low-rise buildings*'.

1.3.4 The SI revealed that the soil underside of foundations is clay with high volume change potential with a plasticity index (PI) range from 46% to 48%. Roots were recovered from underside of foundations and identified as *Quercus* spp, which is oak.

1.3.5 I am informed that there was a previous subsidence claim in 2004 and a nearby oak tree was implicated as the cause of the damage. I have no further information about that claim.

1.4 The Issues to be addressed

The key issues to be addressed are:

1. Is the oak the cause of the present damage?
2. Is any of the other surrounding vegetation implicated in the damage?
3. Was the damage reasonably foreseeable?

1.5 Appendices

The list of appendices to this report is as follows:

Appendix 1 Contains details of my experience and qualifications, appointments, and specialist fields. In addition, a list of my publications is attached.

Appendix 2 A list of the documents supplied to me and documents that I have consulted.

Any technical references are cited as footnotes and/or in the text where appropriate.

2 The Technical Investigation - Findings

- 2.1 I state here for the avoidance of doubt that I did not undertake a site visit before writing this opinion. I relied upon the documents supplied to me including colour photographs, and I viewed the Property on Google Maps Street View™. I consulted several published papers and textbooks on the topic of tree caused subsidence.
- 2.2 The MWA arboricultural assessment of 09 June 2021 identifies the Trees as **T3** an oak and **TG2** a group comprised of ash, goat willow and sycamore. The oak tree is 16.5 m in height with a stem diameter of 1100 mm and a crown spread of 18.5 m. It is located 18.5 m from the damage. The trees in **TG2** are 9 m in height with average stem diameters of 150 mm and an average crown spread of 6 m. **TG2** is 3 m from the damage at its closest point.
- 2.3 The CET site investigation of 07 April 2021 opened one trial pit and two boreholes, TP/BH1 to the right-hand side of the extension, and BH2 to the rear left-hand side of the patio in the rear garden of the Property. This revealed that the foundation of the extension is concrete to 1350 mm deep, and founded onto made ground over 'stiff brown-grey veined CLAY' to 2.8 m with 'very stiff brown-grey veined silty CLAY with claystone modules' to 5 m. The site investigation revealed that the foundation had been underpinned in the past, possibly following the 2004 subsidence claim.
- 2.4 The clay underside of foundations was found to have a high-volume change potential with a modified plasticity index (PI) range of 46% – 48%.
- 2.5 With reference to the liquid and plastic limits, the soil in both BH1 and BH2 was found to be desiccated from 3 m to 5 m below the foundation at the time of the site visit, 07 April 2021 when it would be reasonably expected to have rehydrated following autumn and winter rainfall and the Trees were not in leaf.
- 2.6 Roots of 4 mm diameter were recovered from BH1 to a depth of 2.7 m and identified using light microscopy as *Quercus* spp which is oak.
- 2.7 Three level monitoring readings between 12 July 2021 and 04 November 2021 show that on 13 September 2021 the building moved down by 1 mm and moved up again 04 November 2021 at points 3 & 4 which are located at the side of the extension. An upward movement of 1 mm was recorded on 04 November 2021 at point 6 which was located at the rear of the Property. The amplitude of movement is slight, but it is cyclical and is typical of the activity of tree roots. Upward movement, i.e., crack closure is only ever a result of root activity.

3 Discussion & Opinion

3.1 Causation

3.1.1 From the documents that I have seen I conclude that on the balance of probabilities the oak tree (**T3**) was a material cause of the subsidence damage. My reasons for this conclusion are as follows:

- 1) The side extension is founded on highly shrinkable clay soil with a high-volume change potential.
- 2) The clay soil underside of foundations was desiccated.
- 3) The desiccation was recorded in April, a time of the year when the soil can be expected to have rehydrated following autumn and winter rainfall.
- 4) Level monitoring between July and November 2021 shows a cyclical pattern of movement that is consistent with the activity of tree roots.
- 5) The oak tree is 18.5 m from the damage, within the 90% influencing distance for the genus *Quercus*¹.
- 6) Oak is the genus of tree most commonly implicated in subsidence claims, it is ranked number one in the top ten species of tree implicated in subsidence²³.

3.1.2 It is important to note that only *Quercus* (oak) roots were recovered and identified and, as stated at 7 above oak is the most common genus recorded as causing subsidence damage. I conclude on the balance of probabilities, that the oak tree (**T3**) is the material cause of the subsidence damage.

3.1.3 In order to rectify the problem it will be necessary to remove the oak tree (**T3**) and treat the stump to prevent regrowth. It could be possible to control the oak's water use by cyclical heavy crown reductions. However, research⁴ has shown that such reductions would have to be between 70% and 90% by volume and repeated every other year. Such reductions would destroy the amenity value of the tree and would represent an overly onerous burden on the owner of the tree, the Scout Association. Therefore, removal of **T3** is the prudent option.

¹ Cutler, D F & I B K Richardson (1989). 'Tree Roots & Buildings' 2nd Edition, Longman Scientific & Technical. ISBN 0-582-03410-8

² Mercer, G, A Reeves & D O'Callaghan (2011). 'The relationship between trees, distance to buildings and subsidence events on shrinkable clay soil'. Arb. J Vol33 pp229-245.

³ Fraser, L, G Mercer & D O'callaghan (2020). 'Subsidence & tree rooting depth on shrinkable clay soil'. Arb Magazine 188, Spring 2020 pp 32-35.

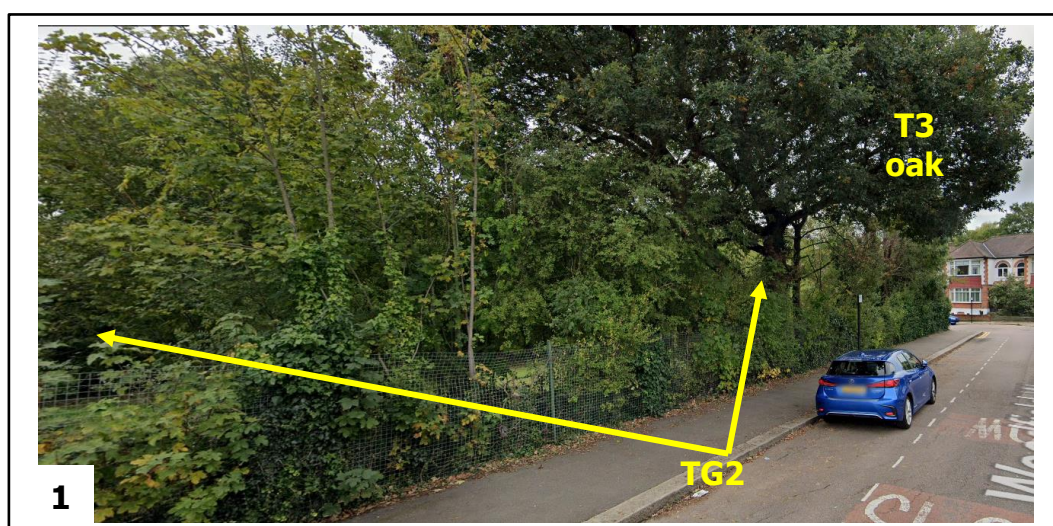
⁴ Hipps, N A, CJ Atkinson & H Griffiths (2006) 'Pruning trees to reduce water use' BRE IP 7/06. BRE Publications.

3 Discussion & Opinion (Continued)

3.2 Other vegetation

3.2.1 The MWA arboricultural assessment implicates a group of trees, **TG2** as a possible cause of the damage. The group is described as a 'mixed group of mostly Goat Willow, Sycamore and Ash'. All these genera, *Salix* (willow); *Acer* spp (sycamore), and *Fraxinus* (ash) are commonly implicated in subsidence damage as they are within the top ten genera as *Salix* spp 5th, *Acer* spp 4th, and *Fraxinus* spp 2nd. However, the only roots identified are *Quercus* spp which is oak.

3.2.2 In my opinion **TG2** was implicated because of its proximity to the area of damage, i.e., it is 3 m from the damage at its closest point, which is within the 50% influencing distance for all three genera. The trees in **TG2** are relatively small and looking at Google Maps Street View dated October 2020 they are relatively young and probably self-set, Photograph 1 below.



3.2.3 The MWA arboricultural report in respect of **TG2** recommends 'Remove (fell) all within 8 m of the building to near ground level and remove regrowth as it emerges. [Herbicide translocation risk to remaining Sycamores and Ash]. Treat stump of Goat Willow to inhibit regrowth'.

3.2.4 I agree with this recommendation because the trees in **TG2** will, if not treated, inevitably grow larger and pose a future threat to the Property. However, to prevent the risk of herbicide translocation, I recommend the use of EcoPlug Max™ which is a closed system and environmentally safe.

3 Discussion & Opinion (Continued)

3.3 Was the damage reasonably foreseeable?

- 3.3.1 Following the recent court cases of *Berent v Family Mosaic Housing and LB Islington*⁵, and *Pattichis v LB Enfield*⁶ both of which went to the issue of reasonable foreseeability, when trees are implicated in subsidence damage, the main point to be decided is whether the owner of a tree should have reasonably foreseen that it would cause damage to a property. The question comes down to whether the trees posed a 'real risk' of causing subsidence damage or simply posed 'a risk'.
- 3.3.2 It is my understanding that the definition of a 'real risk' is one *which it is unreasonable to ignore or do nothing about*. In other words, was it at all times reasonable to foresee that the oak tree would cause subsidence damage to the Property? Deciding whether the tree posed a 'real risk' is dependent upon four criteria, as follows:
- (1) Knowledge that the soil in which the tree is growing and upon which the building is founded is shrinkable clay.
 - (2) That the species/genus of tree implicated is one that is frequently implicated in subsidence damage.
 - (3) That the tree is within influencing distance of a property, and
 - (4) That tree caused subsidence damage is a frequent occurrence in the locality.
- 3.3.3 It has been established that the soil underside of the foundations of the extension is highly shrinkable clay; oak the genus most frequently implicated in subsidence; and the oak (**T3**) within influencing distance of the damage. Therefore, I conclude that criteria (1), (2) and (3) are met.
- 3.3.4 Criterion 4 is key to establishing foreseeability because if historic claim numbers are high in a locality, then it is reasonable to foresee that more claims could occur. In this instance there was a previous claim for subsidence damage at the Property in 2004. I understand that an oak tree was implicated as the cause of the damage. I have no information as to whether the oak implicated in 2004 was **T3**, or another oak (**T2**) that is also within the 90% influencing distance of the property. I understand that the solution adopted in 2004 was to underpin the property and retain the tree. This has not worked given that the damage recurred in 2020.
- 3.3.5 I conclude because of the previous claim criterion 4 has been met and it was foreseeable that the oak tree, **T3**, could cause damage, despite the underpinning. Currently, it is also foreseeable that another oak, **T2**, could cause damage to the Property.

⁵ [2011] EWHC 1353 (TCC)

⁶ The County Court at Central London [2016]: HHJ Parfitt: Claim C20CL016, 2016

3 Discussion & Opinion (Continued)

3.3 Was the damage reasonably foreseeable? (Continued)

- 3.3.6 Until comparatively recently, 2020, there was no method available to predict which trees would cause damage to what buildings. However, research findings of Mercer *et al* (2011) (*Op. Cit.*) and more recent research by Fraser *et al* (*Op. Cit.*) both identified the same top ten genera of trees that are implicated in subsidence with oak (*Quercus* spp) being the most frequent genus implicated in subsidence and plane (*Platanus* spp) being the tenth most frequent genus. It is significant that the two studies cited were 9-years apart and that they identified the same top ten genera. What can be concluded from the studies is that when any trees of the top ten genera are growing on shrinkable clay soil within 10 m of a building, it is likely that they will cause subsidence damage at some time.

4 Conclusions

It is concluded that:

- 4.1 On the balance of probabilities, the oak tree **T3** was a material cause of the subsidence damage to the property at 27 Woodfield Way, London N11 2NP.
- 4.2 It is possible that the trees in **TG2** were a contributory cause of the damage, but no roots of ash, sycamore and willow were recovered and identified.
- 4.3 The solution to the present damage is to remove the oak tree, **T3**, and treat the stump to prevent regrowth because the previous underpinning solution has not worked.
- 4.4 All of the trees in **TG2** within 8 m of the property should be removed and their regrowth controlled.
- 4.5 The damage to the Property was reasonably foreseeable.



Dr Dealga P O'Callaghan
Chartered Arboricultural Consultant

03 February 2022

APPENDIX 1

Professional Resume & Publications of Dr D P O'Callaghan

Dealga P O'Callaghan**Professional Résumé*****Chartered Arboricultural Consultant***

I am Dealga Peadar O'Callaghan, and I am a Chartered Arboricultural Consultant. I hold an Honours Baccalaureate Degree in Biological Science, (BSc. Hons) and a Doctorate in Philosophy (PhD) in Biology. I am the Principal Consultant / Expert at Dealga's Tree Consultancy Ltd.

I am a Chartered Arboriculturist, Fellow of the Institute of Chartered Foresters, (FICFor); an ICF Registered Consultant; and a Fellow of the Arboricultural Association, (F Arbor A). I am a professional Member of the International Society of Arboriculture (MISA) and a Past President of the United Kingdom & Ireland, (UKI), Chapter of that organisation. I acted in the capacity of General Conference Chair for the ISA Annual International Conference held at Birmingham England in August of 1998.

I am involved in Arboricultural Education. I am an Adjunct Full Professor of Arboriculture and Urban Forestry in the Department of Forest Resources at Clemson University in South Carolina, USA and a visiting Lecturer in Arboriculture at the National Centre for Arboriculture, Myerscough College near Preston Lancashire. I am a past Moderator for Arboriculture at Levels 2 & 4 (Certificate & Diploma respectively) and Level 6 (Degree) for ABC Awards and am currently an External Verifier at Lantra. I am an assessor for the Arboricultural Association's Registered Consultant (AARC) scheme and have been an examiner for both the Arboricultural Association Technicians Certificate and the Royal Forestry Society Professional Diploma in Arboriculture. I have also been involved in the development of the ISA Certified Arborist Programme in the United Kingdom and am a Principal Author of the 1st Edition of the Utility Specialist Certification Study Guide.

I have been involved in the development of the arboricultural industry for many years and have served on several National & International Committees and was previously a member of the Arboricultural Association Professional Committee and Consultants Working Group. I have acted as an Associate Editor for the Journal of Arboriculture & Urban Forestry, formerly the Journal of Arboriculture. I represent the ICF on the BSI B/213 Trees Committee.

I am a consultant specializing in tree failure, hazard evaluation, risk assessment related to trees and buildings, planning and development where trees are involved, protection of trees on or close to construction sites, personal accidents involving trees, insurance claims where tree failure is involved and / or building damage occurs which may be attributed to the activity of trees, Tree Preservation Orders, Trees in Conservation Areas, Statutory Designations and Utility Vegetation Management (UVM). Between November 2014 and March 2017, I was registered as a non-salaried inspector (NSI) at the Planning Inspectorate (PINS) for the Fast-Track TPO Appeals and other related casework.

I have over 30 years' experience in planning & development where trees and tree preservation orders are involved. I have acted for many clients both public and private and have experience of public inquiries ranging from small house extensions through to major developments of 1,800 units to national highway and airport runway Inquiries. I have acted in respect of all aspects in the redevelopment of Airfields and the restoration of runway length at Civil Aerodromes. I have also acted for Local Authorities in appeals and public inquiries.

I have considerable experience as an Expert Witness and have acted in many civil and criminal cases in the English, Irish and Manx Court systems. I have acted for both Claimants and Defendants in numerous subsidence recovery cases and have experience of personal injury claims where trees are involved. I have been appointed as a Single Joint Expert in several cases.

I have published several scientific papers in peer reviewed journals, contributed chapters to books and articles in industry magazines. A list of my publications is attached.

PUBLICATIONS of Dr D P O'Callaghan (Chronologically)

O'CALLAGHAN, D.P. (1976) "Aggregation and sex pheromones in the confused flour beetles, *Tribolium confusum* (DV) "Proc 2nd ECRO Confr (Reading).

RYAN, M.F. and **O'CALLAGHAN, D.P. (1976)** "Aggregation and sex pheromones in the beetle *Tribolium confusum*" **J. Insect Physiol** **22(11): 1501-1503.**

O'CALLAGHAN, D.P. and RYAN, M.F. **(1977)** "Production and perception of pheromones by the beetle *Tribolium confusum*" **J. Insect Physiol** **23(10): 1303-1309.**

O'CALLAGHAN, D.P., GALLAGHER, E.M. and LANIER, G.N. **(1978)** "Field evaluation of pheromone baited trap-trees to control elm bark beetles" **J. NY. Entomol Soc** **84(4): 315.**

O'CALLAGHAN, D.P., GALLAGHER, E.M. and LANIER, G.N. **(1980)** "A pheromone baited trap-tree approach to controlling populations of elm bark beetles, vectors of the Dutch Elm disease" **Environ Entomol** **8(2): 181-185.**

KIRBY, S.G., **O'CALLAGHAN, D.P.** and FAIRHURST, C.P. **(1980)** "Dutch Elm Disease; Problems and Prospects" **Landscape Research Volume 6 (2); 29-30.**

O'CALLAGHAN, D.P. (1980) "The current status of the Dutch Elm disease epidemic in Ireland and what can be done about it?" **Viewpoint Column, Taisce Journal** **4(6) 8-9.**

O'CALLAGHAN, D.P. & FAIRHURST, C.P. (1981) "Trap trees to control elm bark beetles, Merseyside Trials, 1980" **Report on Forest Research (1981), Forestry Commission Publications.**

O'CALLAGHAN, D.P. & ATKINS, P.M. (1981) "Towards an Integrated Control Programme for the Dutch Elm Disease" **Arboric J.** **5(4): 250-256.**

ATKINS, P.M., **O'CALLAGHAN, D.P.** & KIRBY, S.G. **(1981)** "*Scolytus laevis* (Chapuis) (*Coleoptera: Scolytidae*) new to Britain." **Entomol. Gazette** **32(4): 280.**

O'CALLAGHAN, D.P. (1982) "The Occurrence of *Scolytus multistriatus* (Marsham) in Ireland " **Irish Nat J** **20 (9): 384-385.**

O'CALLAGHAN, D.P. & GIBBS, J.N. (1982) "Low level of Broodwood Utilisation by Elm Bark Beetles in North West England" **Report on Forest Research 1982, Forestry Commission Publications.**

KIRBY, S.G., **O'CALLAGHAN, D.P.** & FAIRHURST, C.P. **(1982)** "Death Has a Pattern" **GC & HTJ (now Horticulture Week) Nov. 12, 1982, pp 18-22.**

O'CALLAGHAN, D.P. & FAIRHURST, C.P. (1983) "Evaluation of the Trap Tree Technique for the Control of Dutch Elm Disease in Northwest England". In **Dutch Elm Disease Research in Europe. For. Commission Bull.** **60; 23-28.**

O'CALLAGHAN, D.P., ATKINS, P.M. & FAIRHURST, C.P. **(1984)** "Behavioural responses of elm bark beetles to elms killed with cacodylic acid". **J. Chem Ecol** **10 (11): 1623-1634.**

MILLAR, J.G., ZHAO, c-h., LANIER, G.N., **O'CALLAGHAN, D.P.**, GRIGGS, M. & SILVERSTEIN, R.M. **(1986)** "Components of Moribund Elm Trees as attractants to the Elm bark beetles, *Hylurgopinus rufipes* & *Scolytus multistriatus*". **J. Chem. Ecol.** **12 (3): 583-608.**

O'CALLAGHAN, D.P. (1989) "Remedial Tree Work – A Long Term Investment: A Long Term Project". **Arb. J.** **13 (4): 303-311.**

O'CALLAGHAN, D.P. (1991) "Legal protection for trees in Britain & Ireland". **J. Arboric.** **17 (11): 306-312.**

PUBLICATIONS of Dr D P O'Callaghan (Continued)

LAWSON, M. & O'CALLAGHAN, D.P. (1995) "A Critical Analysis of the role of trees in damage to low-rise buildings". **J. Arboric.** **21 (2): 90-97.**

O'CALLAGHAN, D.P. & LAWSON, M (1995) "Trees & Development Conflicts: The importance of advance planning & site control in tree preservation plans". in **Proc. of Trees & Buildings Conference, G. Watson & D. Neeley EDS. ISA Publications.**

O'CALLAGHAN, D.P. & LAWSON, M (1995). "A Critical look at the potential for foundation damage caused by tree roots". in **Proc. of "Trees & Buildings Conference". G. Watson & D. Neeley EDS. ISA Publications.**

O'CALLAGHAN, D.P. & CHARLTON, P.M. (1996). "International Utility Arboriculture". **Arborists News 5(1):13-15.**

O'CALLAGHAN, D.P. & CHARLTON, P.M. (1996). "International Utility Arboriculture". **UAA Quarterly 4(4):1-3.**

O'CALLAGHAN, D.P. (1999) "Planning Installation of Underground Services" in **Landscape Below Ground II, G Watson & D Neeley EDS. ISA Publications.**

O'CALLAGHAN, D P and HAM, D L, (2003) "Study Guide for the Certified Utility Arborist" **ISA Publications, ISBN 1-881956-33-1.**

O'CALLAGHAN, D P (2003) "The Challenges of Planning for Sustainable Environments in Britain" **Arboric. J. 27 (2): 93-116.**

O'CALLAGHAN, D P (2005) "Using Tree Spades to Transplant Trees for Specific Projects" **Tree Line**, Summer 2005 Edition **Pp 15-17.**

O'CALLAGHAN, D.P. and KELLY, O J (2005) "Tree Related Subsidence: Pruning is not the Answer" **J. Building Appraisal 2 (1): 113-129.**

O'CALLAGHAN, D.P. (2005) "The Impact of Tree Related Subsidence on the Urban Tree Population of Britain" **Tree Line**, Autumn 2005 Edition.

O'CALLAGHAN. D P. (2005) "Transplanting Fully Mature Trees- Lessons from Case Histories" **Arboric. J. 29: 19-41.**

MERCER, G, REEVES A & O'CALLAGHAN, D P (2011) "The Relationship between Trees, Distance to Buildings and Subsidence Events on Shrinkable Clay Soil" **Arb. J 33 (4): 229-246.**

O'CALLAGHAN, D P., (2011) "Advances in Utility Arboriculture Research and the Implications for the Amenity and Urban Forestry Sectors" in **Trees, People and the Built Environment; M Johnston and G Percival Editors pages 128-139.** Forestry Commission Publications.

O'CALLAGHAN, D P. (2011) "Veteran Trees & Ancient Woodlands in the Republic of Ireland" **Arb Magazine, Winter Issue 2011.**

O'CALLAGHAN, D P (2012a) "Should Tree Growth Rates Dictate Cutting Cycles on Overhead Power Lines?" **In Proceedings of the Arboriculture Australia Conference, Hobart, Tasmania 2012.**

O'CALLAGHAN D P (2012b) "Integrated Vegetation Management Techniques for Effective Utility Vegetation Management Programmes" **In Proceedings of the Arboriculture Australia Conference, Hobart, Tasmania 2012**

O'CALLAGHAN, D P. (2012c) "Tree Pests and Diseases: Wake Up and Smell the Coffee". **The Arb Magazine, Issue 159, Winter Edition 2012, Pp 28-30**

PUBLICATIONS of Dr D P O'Callaghan (Continued)

STEWART, M G, **O'CALLAGHAN, D P** & HARTLEY, M (**2013a**) "Quantified Tree Risk Assessment: A Critical Review" **The Bark, Magazine of Arboriculture Australia, Vol. 15, No. 1, Pp 17-15.**

STEWART, M G, **O'CALLAGHAN, D P** & HARTLEY, M (**2013b**) "Review of QTRA and Risk-Based Cost Benefit Assessment of Tree Management" **Arboriculture & Urban Forestry 39(4): 165-172.**

LEAD AUTHOR: of the Workbook for Lantra Level 3 Award in Tree Micro-Injection (TMI) to Control Tree Pests and Diseases; (two workbooks; one for Deciduous Trees & Conifers; and one for Palm Trees). (**2015/2017**)

LEAD AUTHOR: of the Workbook for the Lantra Technical Award in the 'Preparation of Mortgage (Home Buyer) Tree Reports' (**2017**)

O'CALLAGHAN, D P & G MERCER (2019) "Tree Related Risk to Buildings" **J. Building Appraisal, Assessment and Valuation 8 (1): 38-52**

FRASER, L, G MERCER & **D P O'CALLAGHAN** (2020) "Subsidence and Tree Rooting Depth on Shrinkable Clay Soil" **Arb Magazine 188, Spring 2020, pp 32-35.**

APPENDIX 2

Documents Provided & Consulted

Documents

1. The Crawford Technical Report on a Subsidence Claim dated 10 October 2020.
2. The Arboricultural Appraisal Report of MWA Arboriculture dated 09 June 2021.
3. The Site Investigation Factual Report of CET Property Assurance dated 07 July 2021.
4. The Root Identification Certificate of ESPL dated 14 April 2021.
5. The Level Monitoring – Relative Survey Readings between 12 July 2021 and 04 November 2021.
6. Tree Roots & Buildings, DF Cutler & I B K Richardson, Second Edition 1989.